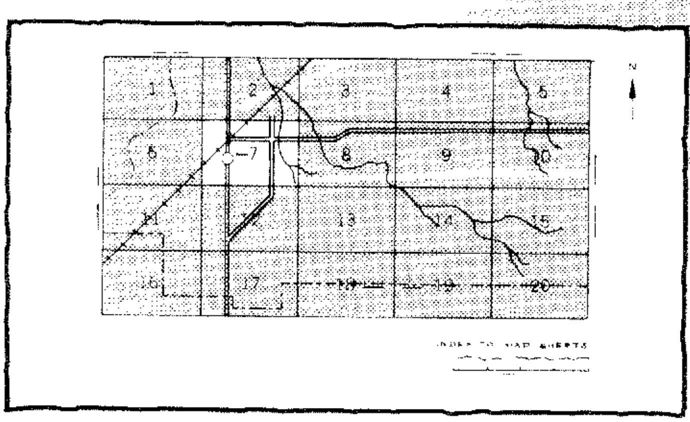
Soil Survey of

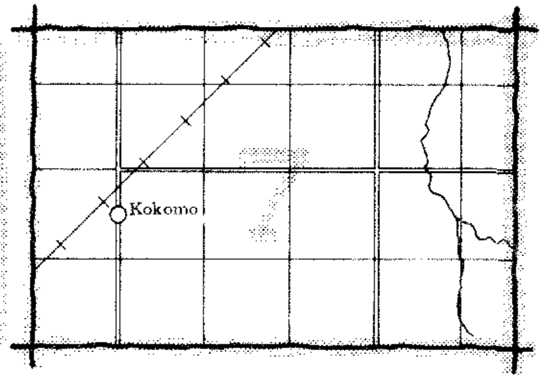
Clay County, Indiana

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Purdue University
Agricultural Experiment Station

HOW TO USE

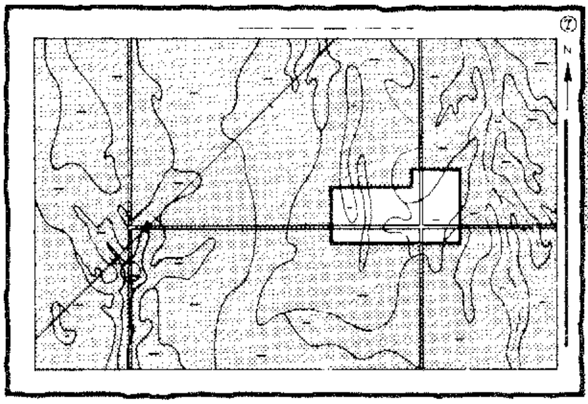
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

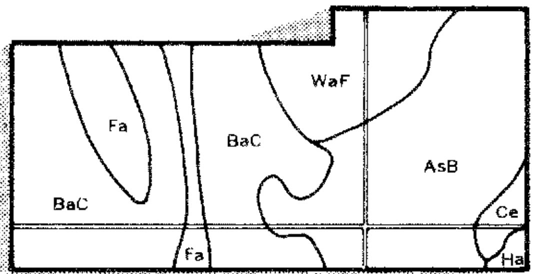




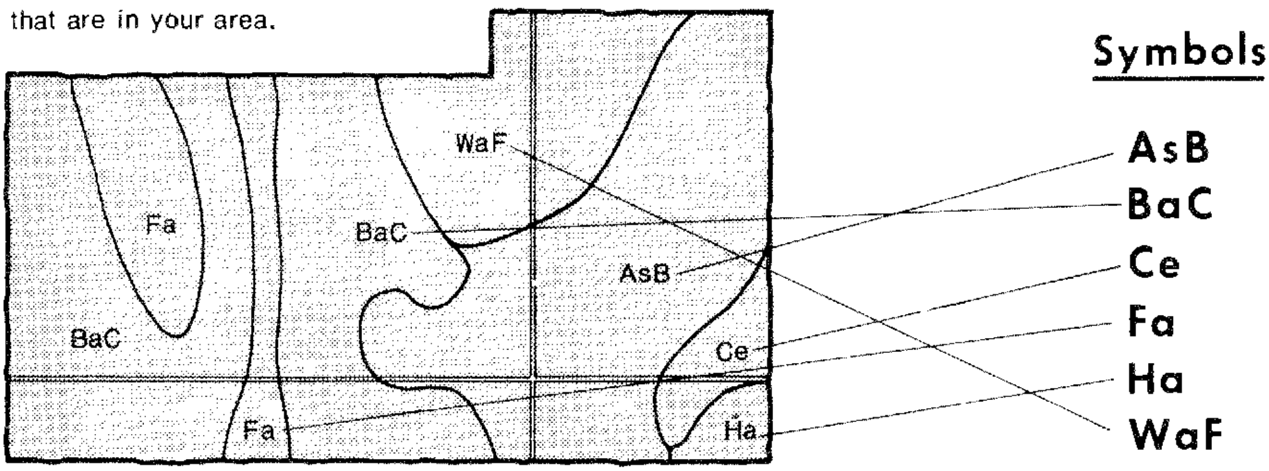
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



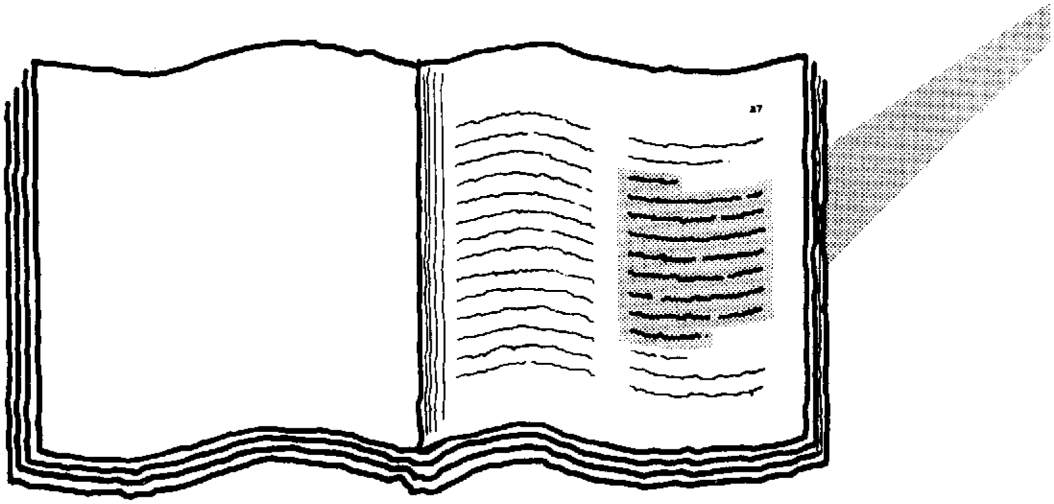


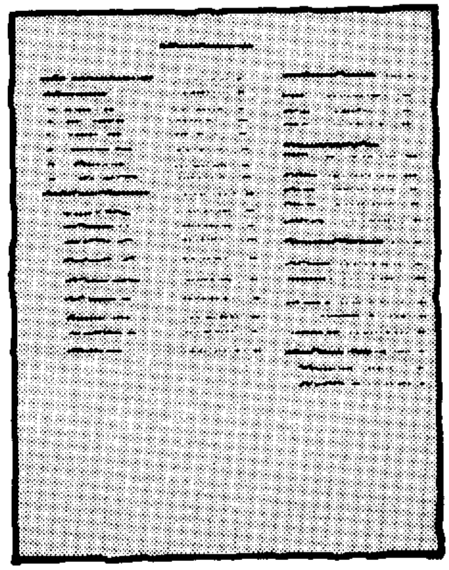
4. List the map unit symbols that are in your area.



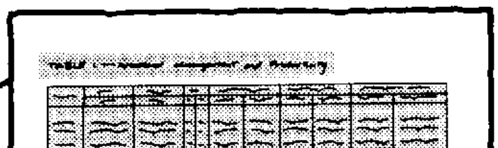
THIS SOIL SURVEY

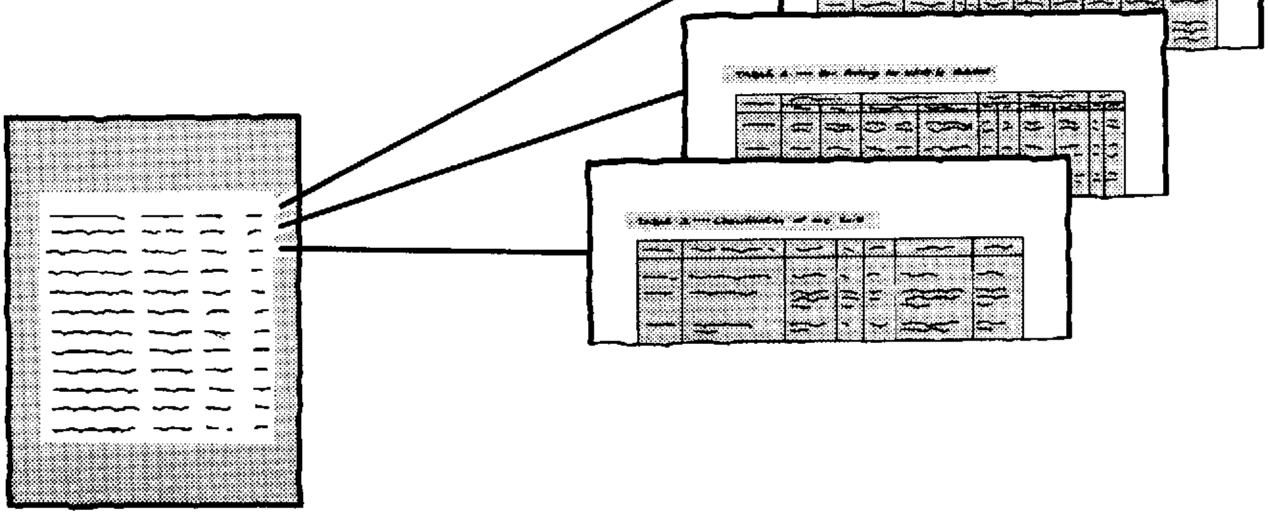
5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.





6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.





7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork was performed in the period 1973-79. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979.

This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Clay County Soil and Water Conservation District. Financial assistance was made available by the Clay County Commissioners.

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soil series

Issued March 1982

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foreword

This soil survey contains information that can be used in land-planning programs in Clay County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

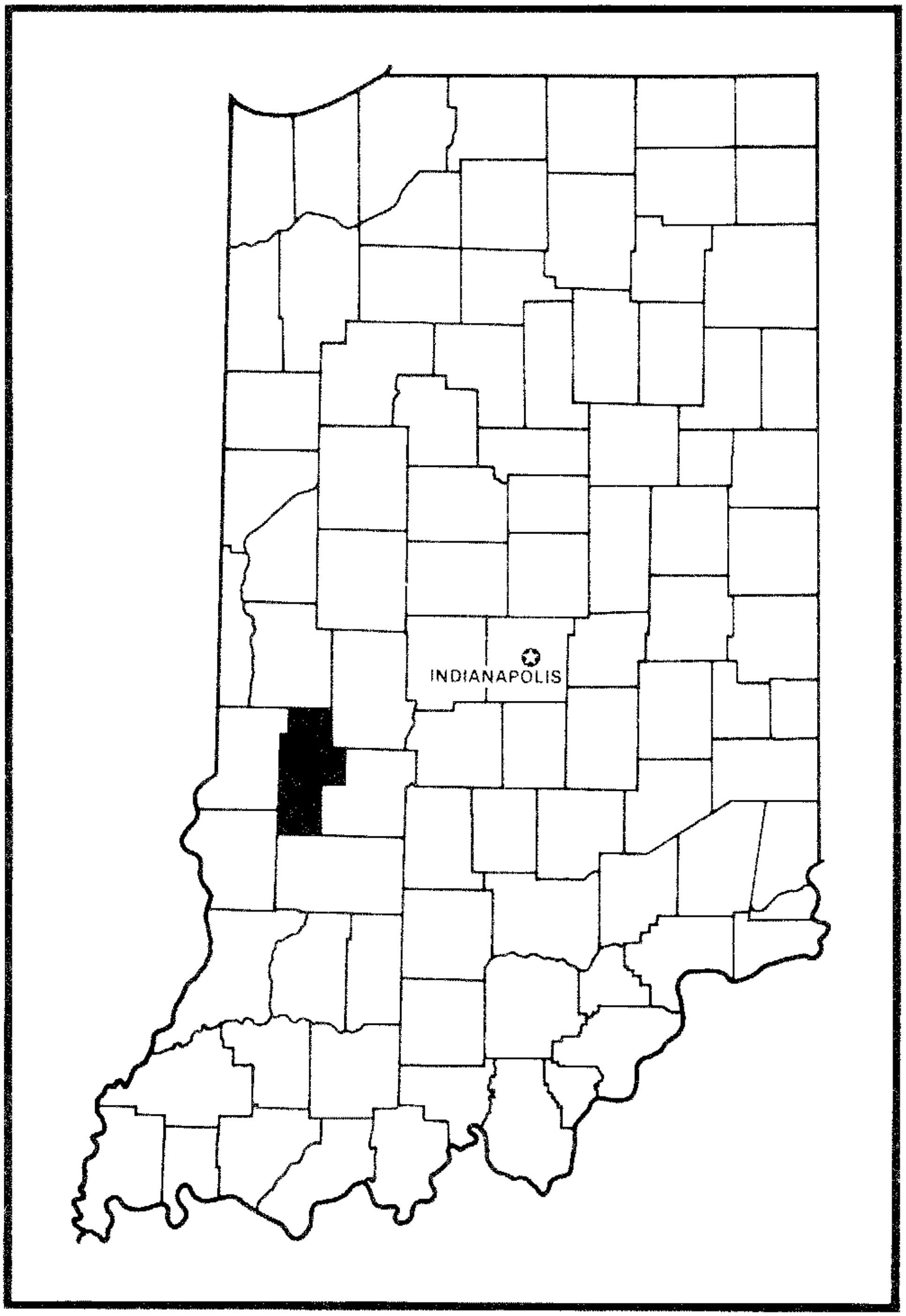
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Robert L Eddleman

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of Clay County in Indiana.

soil survey of
Clay County, Indiana

By Paul McCarter, Jr., Soil Conservation Service

Fieldwork by Paul McCarter, Jr., Travis Neely, and Leo A. Kelly,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with
Purdue University Agricultural Experiment Station

CLAY COUNTY is in the west-central part of Indiana. It has an area of 364 square miles, or 232,960 acres. The county has a maximum width from east to west of 16 miles and a maximum length from north to south of 30 miles. Brazil, the county seat and largest town, is in the northern part of the county.

The population of Clay County was 23,933 in 1970. Most of the people make their living from farming, from farm related industries, or from working in factories and businesses in Brazil or Terre Haute.

In 1967, according to the Indiana Soil and Water Conservation Needs Inventory, about 53 percent of the land in the county was used for cropland, 10 percent was used for pasture, 20 percent was used for woodland, and 17 percent was in other uses (*3*). Many areas near local towns and throughout the county are used for dwellings.

Clay County's most valuable natural resources are productive soils and coal. The first large scale coal mining operations were in the middle 1800's and consisted of underground mines. Surface mining was started after large earthmoving machines were developed.

The climate is mid-continental, and temperature fluctuates widely between seasons. Rainfall is generally adequate, and the growing season is long enough for the production of crops commonly grown.

Farming in Clay County is based mainly on cash-grain and livestock enterprises, chiefly hogs and cattle. Corn, soybeans, and wheat are the main crops.

general nature of the county

Additional information about the survey area and general features that affect the use of the soils are given in this section. Described are settlement; climate; relief and drainage; water supply; transportation; manufacturing and business services; and trends in population and land use.

settlement

The first settlement in Clay County was made in the fall of 1818 on the highlands along the Eel River. From 1820 to 1825, settlements were made on the hills east of the river near the present site of Poland.

When the county was organized, the Poland neighborhood was the most populous part of the county. The county seat, originally at Bowling Green, was moved to Brazil in 1871.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Clay County is cold in winter and hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. Normal annual precipitation is adequate for all crops that are adapted to the temperature and length of growing season in the area.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Terre Haute, Indiana, in the period 1955-76. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Terre Haute on January 28, 1963, is -19 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on June 30, 1959, is 101 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 23 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.68 inches at Terre Haute on July 21, 1973. Thunderstorms occur on about 50 days each year, and most occur in summer.

Average seasonal snowfall is 14 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 11 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70 in summer and 40 in winter. The prevailing wind is from the southwest. Average windspeed is highest, 11 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are usually local and of short duration and cause damage in a variable pattern.

relief and drainage

Most of the soils in Clay County formed on uplands in thick loess, in loess mantled glacial till, or in wind-deposited sands or they formed on bottom lands in recently deposited alluvium. The soils on uplands range from nearly level to very steep. The soils in bottom lands are nearly level. Most soils are medium textured.

The main management need on the gently sloping to very steep upland soils is protection from erosion. Drainage is needed on the nearly level, somewhat poorly drained to very poorly drained soils on uplands or bottom lands. In addition, protection from flooding is generally needed for soils on bottom lands.

Most of Clay County is within the Wabash lowland physiographic unit. Along the eastern side of the county, a small part is in the Crawford upland (*13*).

The physiography of the county is characterized by broad, flat uplands that are dissected by moderately sloping to very steep drainageways and flat bottom lands along streams.

The highest elevation is about 790 feet. It is in the northeastern part of the county near Lena. The lowest elevation is about 500 feet along the Eel River in the southeastern corner.

Most of Clay County is drained by the Eel River and its tributaries. The main streams that drain into the Eel River are Croys Creek, Birch Creek, McIntyre Creek, Splunge Creek, Jordan Creek, Six-Mile Creek, and the Connelly Ditch. Otter Creek drains the northwestern part of the county.

water supply

Drilled wells are the main source of water supply in the county. Dug wells and a few driven wells and springs are also used.

In upland areas, most wells are 100 to 200 feet deep. Yield of water from these wells generally ranges from 1 gallon to 20 gallons per minute, but some wells are dry. On bottom lands along Eel River, wells that produce several hundred gallons per minute can be developed in underlying sand and gravel formations. The towns of Brazil, Center Point, Clay City, Staunton, and Bowling Green obtain their water supply from deep wells.

The quality of water from drilled wells varies greatly. In some areas the content of iron, chloride, or sulphate exceeds the U.S. Public Health Service standards for drinking water (*12*).

In areas where the supply of water from wells is low, water from lakes and ponds is used. A large number of farm ponds have been constructed for water supply, fire protection, and wildlife habitat. In some strip mining areas, water from lakes that formed in excavations is used.

transportation

Two railroads cross the northern part of Clay County. The Brazil area is served by one of these. A railroad crosses the southwestern corner of the county at Coalmont. U.S. Highway 40, Interstate 70, and a network of state highways traverse the county. All areas of the county are served by county roads. Many of the county roads are gravelled; some are paved. An airport is southeast of Brazil.

manufacturing and business services

Brazil is the manufacturing center of the county. Industries include the manufacture of clay products, mobile homes, and truck trailers. Coal mining is an important activity in the county.

Markets for livestock are within a reasonable distance. Terre Haute and Indianapolis are the major markets.

Grain elevators and truck and rail transportation provide adequate facilities for handling grain at harvest time.

trends in population and land use

The population of Clay County increased from the first settlement in 1818 to 29,447 in 1920 (*4*). It had decreased to 23,933 in 1970.

There were 2,414 farms in 1920 but only 873 farms in 1974 (*10*). The average size of farm was 84.7 acres in 1920 and 192 acres in 1974. The proportion of the county in farms was 89 percent in 1920 compared to 72 percent in 1974.

From 1964 to 1974, the number of cattle decreased and the number of hogs increased. During recent years, the acreages of corn and soybeans have increased, and the acreages of wheat, hay, and pasture have decreased.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places (*5*). They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, specialty crops, woodland, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

The names, descriptions and delineations of soils on the general soil map of Clay County do not always agree or join fully with those of adjoining counties published at an earlier date. This difference is due to changes in concepts of soil series in the application of the soil classification system. Other differences are brought about by a difference in the predominance of soils in map units made up of two or three series. Still other differences may be caused by the range in slope within the map unit of adjoining surveys. In this county or in adjacent counties a map unit is sometimes too small to be delineated.

1. Iva

Nearly level, somewhat poorly drained soils formed in loess; on uplands

Areas of this map unit consist of broad flats and nearly level divides between draws on uplands. The areas are very large and extend for many miles.

This unit occupies about 40 percent of the county. It is about 50 percent Iva soils and 50 percent soils of minor extent.

The Iva soils are somewhat poorly drained and nearly level. They are on broad flats and nearly level divides between draws. Permeability is slow. The surface layer is grayish brown silt loam, and the subsoil is mainly light brownish gray, mottled silt loam and silty clay loam.

The soils of minor extent include the well drained Fairpoint soils on narrow ridges of mine spoil, the poorly drained Hoosierville soils on broad flats, and the moderately well drained Muren soils on narrow ridgetops or knolls. Also included are the somewhat poorly drained Cory soils on broad flats and in shallow depressions at the head of drainageways, the poorly drained Vigo soils on broad flats and divides between draws, and the moderately well drained Ava soils on knolls or narrow ridgetops and on breaks along drainageways. The well drained Pike soils are on ridgetops or knolls.

The soils in this unit are used mainly for cultivated crops. Most areas have been drained so that crops can be grown, but drainage is still needed in many places.

The drained soils are well suited to corn, soybeans, and small grain. Wetness is the main limitation for farming, and drainage is necessary.

Sanitary facilities and building site development are poorly suited to areas of this unit. Wetness is the main limitation.

2. Hickory-Cincinnati-Ava

Gently sloping to very steep, well drained and moderately well drained soils formed in loess and the underlying glacial till; on uplands

Areas of this map unit are on uplands and consist of narrow ridgetops, deep draws that extend between broad

flats and nearly level divides, and narrow bottom lands. Most areas are narrow and elongated and extend for several miles along streams and drainageways between large upland flats.

This unit occupies about 25 percent of the county. It is about 23 percent Hickory soils, 15 percent Cincinnati soils, 15 percent Ava soils, and 47 percent soils of minor extent (fig. 1).

The Hickory soils are well drained and strongly sloping to very steep. They are in draws and on breaks to bottom lands. Permeability is moderate. The surface layer is very dark brown loam, and the subsoil is yellowish brown and strong brown clay loam and sandy clay loam.

The Cincinnati soils are well drained and moderately sloping. They are on ridgetops or knolls and on breaks along drainageways. These soils have a fragipan, and permeability is slow. The surface layer is yellowish brown silt loam, and the subsoil is mainly yellowish brown loam and clay loam.

The Ava soils are moderately well drained and gently sloping. They are on narrow ridgetops or knolls and on breaks along drainageways. These soils have a fragipan, and permeability is very slow. The surface layer is brown silt loam, and the subsoil is mainly yellowish brown, mottled silt loam and loam.

The soils of minor extent include the well drained Fairpoint soils on narrow ridges of coal mine spoil, the somewhat poorly drained Iva soils on nearly level divides between draws, and the moderately permeable Pike soils on knolls and ridgetops. The somewhat poorly drained Shoals and Stendal soils are in narrow bottom lands.

The deep draws and narrow bottom lands are used mainly for woodland. Ridgetops and divides are used mainly for cultivated crops. Runoff and erosion are hazards in the draws and on the ridgetops. Slope in the draws severely limits the use of farm machinery. Wetness is a limitation to farming and most other uses on nearly level divides and in narrow bottom lands. The narrow bottom lands are subject to flooding.

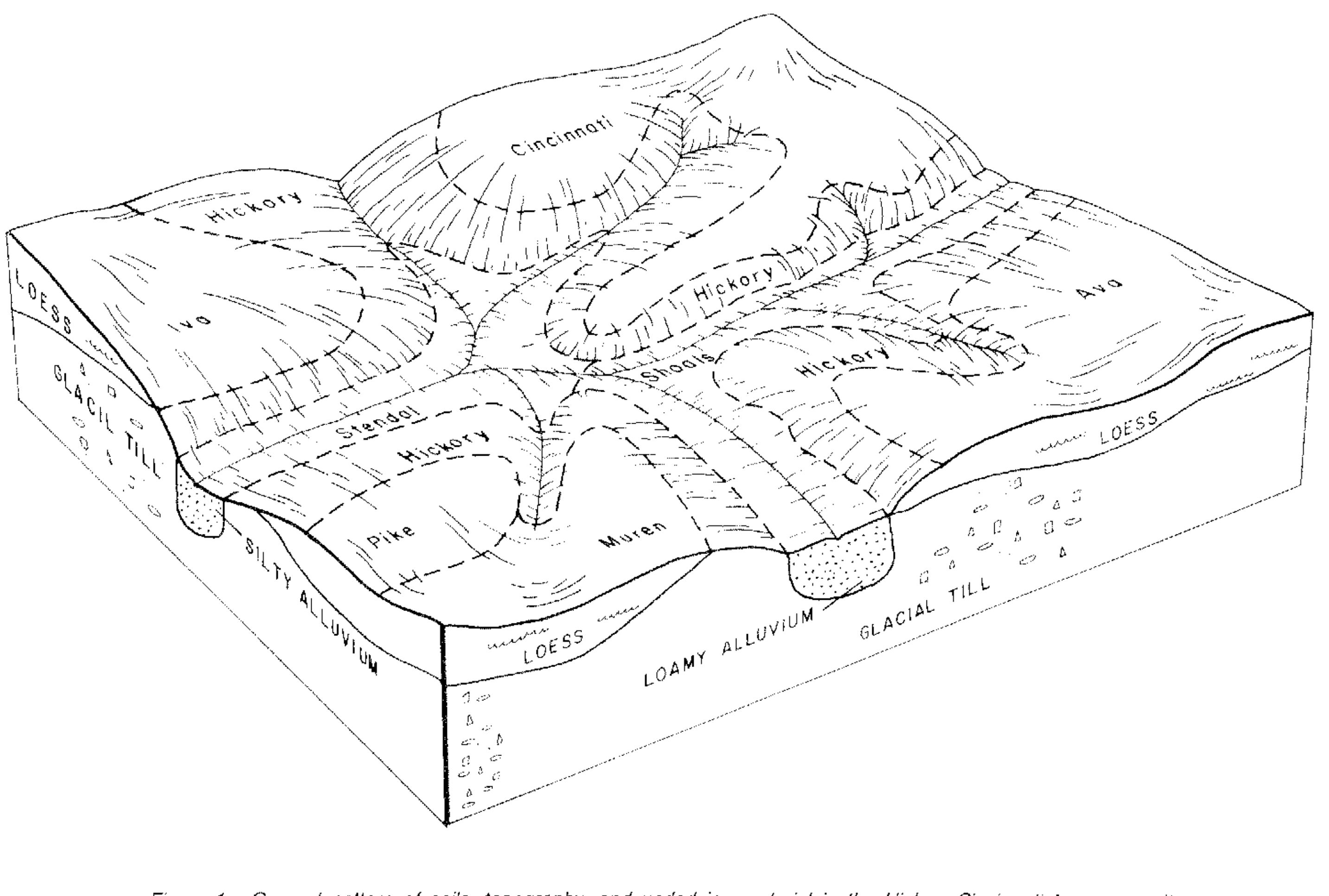


Figure 1.—General pattern of soils, topography, and underlying material in the Hickory-Cincinnati-Ava map unit.

The soils in this unit are poorly suited to corn, soybeans, and small grain, mainly because of the slope. The Ava soils are suited to cultivated crops, but erosion is a hazard, Cincinnati soils are well suited to pasture and hay. The soils in this unit are suited to trees.

Sanitary facilities and building site development are moderately suited to areas of this unit. Slopes, restricted permeability, and wetness are the main limitations.

3. Stendal-Shoals-Newark

Nearly level, somewhat poorly drained soils formed in alluvium; on bottom lands

Areas of this map unit consist of the back part of bottom lands along large streams and narrow bands along small streams. The areas are large and irregular in shape.

This unit occupies about 13 percent of the county. It is about 32 percent Stendal soils, 23 percent Shoals soils, 17 percent Newark soils, and 28 percent soils of minor extent.

The Stendal soils are somewhat poorly drained. They formed in acid, silty alluvium. Permeability is moderate. The surface layer is brown silt loam, and the subsoil is mainly light brownish gray, mottled silt loam.

The Shoals soils are somewhat poorly drained. They formed in neutral alluvium. Permeability is moderate. The surface layer is dark grayish brown silt loam, and the subsoil is mainly brown and grayish brown, mottled silt loam and loam.

The Newark soils are somewhat poorly drained. They formed in neutral alluvium. Permeability is moderate. The surface layer is brown silt loam, and the subsoil is pale brown and grayish brown, mottled silt loam.

The soils of minor extent include the poorly drained or very poorly drained Bonnie soils in broad bottom lands and the moderately well drained Lobdell and Steff soils on elongated low rises and strips along streams in bottom lands.

The soils in this unit are used mainly for cultivated crops. Most areas have been drained so that crops can be grown, but drainage is needed in many places.

These soils are moderately suited to corn, soybeans, and small grain. Frequent flooding is a hazard, and wetness is a limitation to farming. These soils are well suited to pasture and trees.

Sanitary facilities and building site development are generally not suitable for areas of this unit. Flooding is a hazard, and wetness is a limitation.

4. Chagrin-Nolin-Wilbur

Nearly level, well drained and moderately well drained soils formed in alluvium; on bottom lands

Areas of this map unit are along stream channels and swales or sloughs in broad bottom lands of large streams. The areas are irregular in shape.

This unit occupies about 7 percent of the county. It is about 41 percent Chagrin soils, 12 percent Nolin soils, 12 percent Wilbur soils, and 35 percent soils of minor extent.

The Chagrin soils are well drained. Permeability is moderate. These soils formed in neutral, loamy alluvium, mainly along stream channels. The surface layer is dark brown silt loam, and the subsoil is brown and dark yellowish brown silt loam.

The Nolin soils are well drained. Permeability is moderate. These soils formed in neutral, silty alluvium on broad, somewhat higher bottoms. The surface layer is brown silt loam, and the subsoil is dark yellowish brown and yellowish brown silt loam.

The Wilbur soils are moderately well drained. Permeability is moderate. These soils formed in neutral, silty alluvium on broad bottom lands. The surface layer is brown silt loam, and the subsoil is brown silt loam.

The soils of minor extent include the moderately well drained Lobdell soils that contain more clay and sand, the somewhat poorly drained Shoals soils on broad bottom lands, and the well drained Stonelick soils on low rises between swales.

The soils in this unit are used mainly for cultivated crops. Flooding is a hazard to farming and to most other uses.

These soils are well suited to corn, soybeans, and small grain and to pasture and trees.

Sanitary facilities and building site development are generally not suitable for areas of this unit. Flooding is a hazard.

5. Alvin-Princeton-Ayrshire

Deep, nearly level to moderately sloping, well drained and somewhat poorly drained soils formed in wind-deposited sand and silt; on uplands

Areas of this map unit consist of undulating, low, narrow ridges and alternate small flats and depressions that are between the higher lying loess and till uplands and the lower lying bottom lands.

This unit occupies about 4 percent of the county. It is about 30 percent Alvin soils, 25 percent Princeton soils, 20 percent Ayrshire soils, and 25 percent soils of minor extent (fig. 2).

The Alvin soils are well drained and gently sloping and moderately sloping. They are on ridges, knolls, and in draws. Permeability is moderately rapid. The surface layer is dark brown loamy fine sand, and the subsoil is mainly brown and strong brown fine sandy loam and loamy fine sand.

The Princeton soils are well drained and gently sloping or moderately sloping. They are on ridges and knolls. Permeability is moderate. The surface layer is mainly dark brown fine sandy loam, and the subsoil is mainly brown and dark brown loam and sandy loam.

The Ayrshire soils are somewhat poorly drained and nearly level. They are on flats between ridges and in

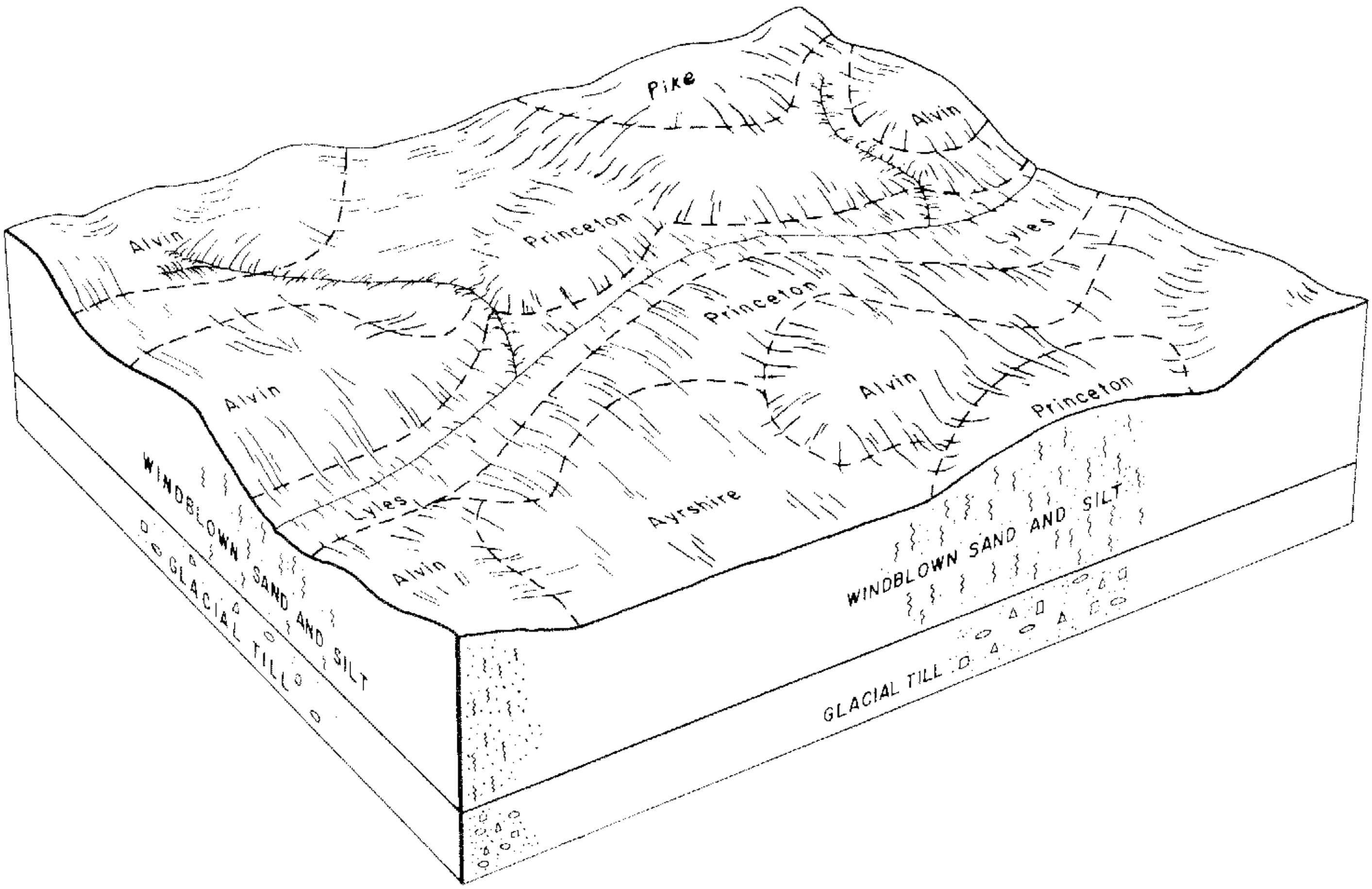


Figure 2.—General pattern of soils, topography, and underlying material in the Alvin-Princeton-Ayrshire map unit.

drainageways. Permeability is moderate. The surface layer is mainly dark grayish brown fine sandy loam, and the subsoil is mainly yellowish brown and light brownish gray, mottled loam and sandy clay loam.

The soils of minor extent include the very poorly drained Lyles soils in swales and depressions and the somewhat poorly drained Stendal soils on narrow bottom lands along small streams.

The soils in this unit are used mainly for cultivated crops. Erosion is a hazard on the ridges and knolls. Soil blowing is a hazard on Alvin soils. Wetness is a limitation for soils on the flats and in depressions.

These soils are suited to corn, soybeans, and small grain and to pasture and trees.

Sanitary facilities and building site development are well suited to areas of this unit. Slope is a limitation, however, on Alvin and Princeton soils, and wetness is a limitation on Ayrshire soils.

6. Hickory-Muren-Cincinnati

Nearly level to very steep, well drained and moderately well drained soils formed in loess or in loess and the underlying glacial till; on uplands

Areas of this map unit are on ridges and in valleys. They consist of narrow, gently sloping ridgetops, deep draws, and narrow bottom lands.

This unit occupies about 6 percent of the county. It is about 34 percent Hickory soils, 28 percent Muren soils, 18 percent Cincinnati soils, and 20 percent soils of minor extent (fig. 3).

The Hickory soils are well drained and strongly sloping to very steep. Permeability is moderate. They are in draws and on breaks to bottom lands. The surface layer is mainly very dark brown loam, and the subsoil is yellowish brown and strong brown clay loam and sandy clay loam.

The Muren soils are moderately well drained and nearly level and gently sloping. They are on narrow ridgetops or knolls. Permeability is moderately slow. The surface layer is brown silt loam, and the subsoil is yellowish brown, mottled silty clay loam and silt loam.

The Cincinnati soils are well drained and moderately sloping. They are on ridgetops or knolls and on breaks along drainageways. These soils have a fragipan, and permeability is slow. The surface layer is yellowish brown silt loam, and the subsoil is mainly yellowish brown silty clay loam and loam.

The soils of minor extent include the moderately deep, well drained Berks and Gilpin soils in deep draws and on breaks to bottom lands, the somewhat poorly drained Stendal soils in narrow bottom lands, and the poorly drained Vigo soils on nearly level divides between draws.

The deep draws and narrow bottom lands are used mainly for woodland. Ridgetops and divides are used mainly for cultivated crops. Runoff and erosion are hazards in the draws and on the ridgetops. Slope in the draws severely limits the use of farm machinery. Wetness is a limitation to farming and most other uses on nearly level divides and in narrow bottom lands. The bottom lands are subject to flooding.

The soils in this unit are poorly suited to corn, soybeans, and small grain mainly because of steepness. The Muren soils are suited to cultivated crops, but erosion is a hazard. Cincinnati soils are well suited to pasture and hay, and Muren soils are well suited to trees.

Sanitary facilities and building site development are poorly suited to areas of this unit. Slope, restricted permeability, and wetness are the main limitations.

7. Evansville-Peoga-Zipp

Nearly level, poorly drained and very poorly drained soils formed in silty and clayey sediments; on lake plains, terraces, and bottom lands

Areas of this map unit consist of broad flats that are lower than the surrounding uplands and slightly higher than nearby bottom lands. Areas are large and irregular in shape.

This unit occupies about 5 percent of the county. It is about 30 percent Evansville soils, 30 percent Peoga soils, 28 percent Zipp soils, and 12 percent soils of minor extent.

The Evansville soils are poorly drained and nearly level. Permeability is moderate. The surface layer is dark

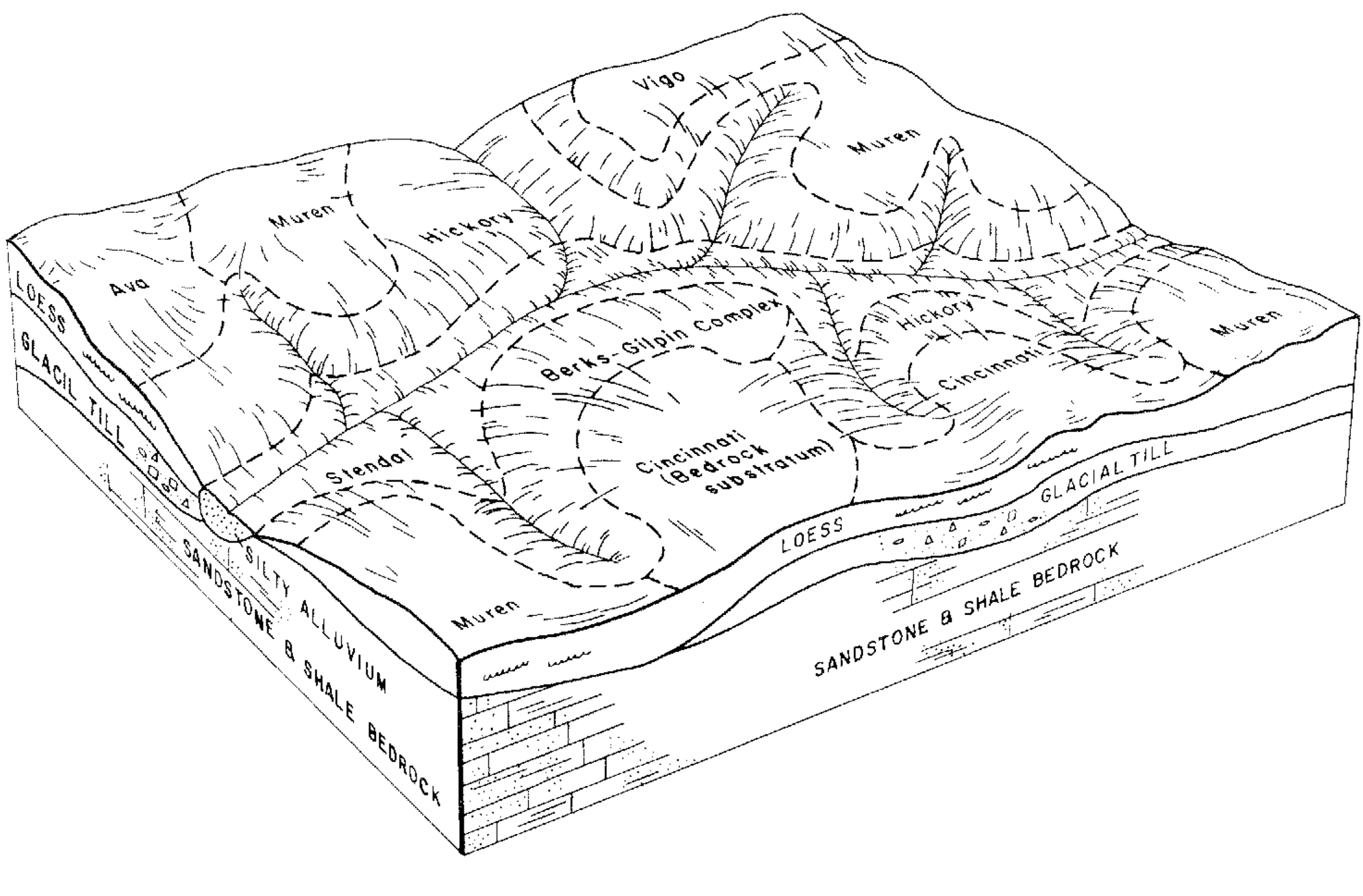


Figure 3.—General pattern of soils, topography, and underlying material in the Hickory-Muren-Cincinnati map unit.

grayish brown silt loam, and the subsoil is mainly gray, mottled silty clay loam.

The Peoga soils are poorly drained and nearly level. Permeability is slow. The surface layer is dark grayish brown silt loam, and the subsoil is mainly gray, mottled silty clay loam.

The Zipp soils are very poorly drained and nearly level. Permeability is very slow. The surface layer is dark grayish brown silty clay, and the subsoil is gray, mottled silty clay.

The soils of minor extent are the somewhat poorly drained Henshaw soils on low terraces and the very poorly drained Montgomery Variant soils on the lowest part of lake plains. The Montgomery Variant soils have a thicker, darker surface layer than the major soils.

The soils in this unit are used mainly for cultivated crops. Most areas have been drained so that crops can be grown, but drainage is needed in many places. Flooding is a hazard, and wetness is a limitation for farming and most other uses.

The drained soils are well suited to corn, soybeans, and small grain. These soils are well suited to pasture and suited to trees. Wetness is the main limitation.

Sanitary facilities and building site development are poorly suited to areas of this unit. Flooding is a hazard, and wetness is a limitation.

broad land use considerations

Land use is an important consideration in the survey area. The soils in the county have wide ranges in suitability and potential for many different uses. Often soils that have good potential for one land use will have poor potential for another. For example, Chagrin soils have poor potential for urban uses because they are subject to flooding, but they are suited to cultivated crops. The general soil map provides helpful information for planning the land use of broad areas. It cannot be used for the selection of sites for specific urban structures.

A high percentage of soils in some areas are productive and are either free of limitations or have limitations that are economically feasible to overcome. The Iva map unit, for example, has good potential for cultivated crops because it has been partially drained. The Hickory-Muren-Cincinnati map unit, however, has a high percentage of steep or very steep soils and is poorly suited to cultivated crops.

Some map units are suited to vegetables and other specialty crops. The Alvin-Princeton-Ayrshire map unit has good potential for these uses. The Alvin and Princeton soils in this unit are suited to melons, plant nurseries, and peach and apple orchards. These soils warm up earlier in spring than soils that are wet. The Stendal-Shoals-Newark map unit, however, has poor potential for specialty crops because it is subject to frequent flooding.

Most of the soils in the county have good potential for woodland. The steep and very steep soils in the Hickory-Muren-Cincinnati map unit have poor potential for most farm uses but have good potential for woodland.

Some map units consist mainly of soils that are poorly suited to most urban uses. For example, the Stendal-Shoals-Newark map unit is on bottom lands, and is subject to frequent flooding. The soils in the Iva map unit require extensive drainage systems if wetness limitations are to be overcome. The well drained soils of the Alvin-Princeton-Ayrshire map unit can be developed for urban uses at lower cost than wetter, less suitable soils. The very steep soils of the Hickory-Muren-Cincinnati map unit can be used for urban development, but construction costs are greater. Also, the Gilpin and Berks soils in this unit are underlain with bedrock, which commonly increases the cost of excavation.

Many map units have poor potential for intensive recreation areas, such as playgrounds, picnic areas, and campgrounds, because of wetness, slope, or flooding. The Alvin-Princeton-Ayrshire map unit has better potential than most other units. The gently sloping Princeton soils and areas of similar, less extensive soils are better suited for such facilities. The large number of hardwood trees on the Hickory soils enhances the beauty of the map units in which they are included. All of the units provide habitat for many kinds of desirable wildlife.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hickory silt loam, 18 to 25 percent slopes, is one of several phases in the Hickory series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Berks-Gilpin complex, 30 to 70 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Extremely acid mine spoil is an example. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with soil maps for adjacent counties published previously. Differences are the result of better knowledge of soils, modification of series concepts, intensity of mapping, and extent of the soils within the survey. The composition of map units varies from one county to another. Sometimes it is more feasible to combine small acreages of similar soils that respond to use and management in much the same way than to separate them.

AnC—Alvin loamy fine sand, 4 to 12 percent slopes. This soil is gently sloping and moderately sloping, deep, and well drained. It is on ridges and knolls on uplands. Areas are irregular in shape and range from 3 to 100 acres. Dominantly, slope is about 8 percent.

Typically, the surface layer is dark brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 7 inches thick. The subsoil is about 49 inches thick. The upper part is brown, very friable fine sandy loam; below this is strong brown, very friable loamy fine sand with sandy loam bands; and the lower part is strong brown, very friable fine sand. The substratum to a depth of 70 inches is yellowish brown fine sand. In places, particularly on west-facing slopes, soil blowing has removed the upper part of the profile, and the surface layer consists mainly of brown fine sandy loam. In places, the loamy fine sand is more than 20 inches thick.

Included with this soil in mapping are small areas of somewhat poorly drained Ayrshire soils in swales. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is moderately rapid. Organic matter content of the

surface layer is moderately low, and surface runoff is medium. The surface layer is very friable and easy to work when moist, but when dry the soil is loose and traction is poor for tillage equipment.

Most areas of this soil are used mainly for cultivated crops. Some areas are used for pasture or hay, and a few areas remain in woodland. This soil is well suited to melons and fruit trees. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

This Alvin soil is suited to corn or soybeans and small grain. Conservation practices are needed to control erosion and runoff and to prevent soil blowing in cultivated cropland. Farming on the contour is practical in a few areas that have long, even slopes. Crop rotation and conservation tillage that leaves protective crop residue on the surface help prevent excessive soil loss. Return of crop residue to the soil and the use of cover crops help control erosion and soil blowing and help to maintain the organic matter content. Crop residue, if left on the surface as mulch, helps conserve soil moisture. Subsurface drainage is needed in many small swales of the included Ayrshire soils.

Grasses and legumes grown for hay and pasture effectively control erosion and soil blowing. Alfalfa grows well on this soil. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of slope. Designing buildings to complement the slope, land shaping, and installing retaining walls help overcome this limitation. Areas disturbed during construction should be revegetated during or after construction. Slope and frost action are moderate limitations for local roads and streets. Constructing local roads and streets on the contour and shaping the land help overcome the slope limitation. Providing adequate side ditches and culverts along roads helps reduce the frost action. Septic tank absorption fields are moderately limited because of slope. Shaping the land and installing distribution lines across the slope generally are necessary for proper functioning of the absorption field.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

AvB2—Ava silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping, deep, and moderately well drained. It is on knolls and ridgetops and on breaks along drainageways on uplands. Slopes are 75 to 250 feet long. Areas are generally narrow and elongated and range from 2 to 30 acres.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsurface layer is light yellowish brown silt loam about 3 inches thick. The upper part of the subsoil is yellowish brown, friable silt loam; below this is yellowish brown, mottled, friable silt loam; next is strong brown, mottled, very firm and brittle silt loam (fragipan); next is yellowish brown, mottled, very firm and brittle loam (fragipan); the lower part to a depth of 80 inches is yellowish brown, mottled, friable loam. The depth to loamy glacial till is more than 45 inches in some areas. Some areas do not have grayish mottles in the upper 24 inches. Areas in woods, which are not eroded, have a very dark grayish brown or dark brown surface layer.

Included with this soil in mapping are small areas of nearly level, somewhat poorly drained Iva soils on ridgetops and in drainageways. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is very slow. The organic matter content is moderately low, and surface runoff is rapid. The fragipan restricts water movement and plant root growth. The surface layer is friable and easy to till through a fairly wide range of soil moisture. The perched, seasonal high water table fluctuates at depths between 2 and 4 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few areas remain in woodlots.

This Ava soil is suited to corn, soybeans, and small grain. Runoff and erosion are hazards. Crop rotations, farming on the contour, and conservation tillage that leaves protective crop residue on the surface help prevent erosion. In places where slopes are long and uniform, terraces are suited and can be used to prevent erosion. Grassed waterways help prevent gullying in drainageways. The fragipan restricts root development and causes a perched water table. Farming operations are commonly delayed by the resulting seepage on slopes. Subsurface drains intercept the seepage and drainage areas of Iva soils.

Grasses and legumes grown for hay and pasture are well suited to this soil and are effective in preventing erosion. Many grasses and legumes are suited, but deep-rooted legumes, such as alfalfa, are often damaged by frost heaving. Overgrazing and grazing when the soil is too wet cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. The use of this soil as woodland effectively prevents erosion. Plant competition is the main management concern. Competing vegetation can be controlled by cutting, spraying, and girdling.

This soil is moderately limited for dwellings without basements because of wetness and shrinking and swelling. It is severely limited for dwellings with basements because of wetness. Drains around footings help remove excess water. Foundations, footings, and

basement walls should be strengthened. Backfilling with a coarser material helps prevent structural damage caused by shrinking and swelling. Frost action and low strength are severe limitations for local roads and streets. Replacing the moderate shrink-swell layers of this soil with suitable soil material and covering the surface with suitable base material help overcome these limitations. The very slow permeability of the fragipan and wetness are severe limitations for septic tank absorption fields. These limitations can be reduced by replacing the slowly permeable material with more permeable material and installing subsurface drains around the outer edges of the absorption field to remove excess wetness.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

Ay—Ayrshire fine sandy loam. This soil is nearly level, deep, and somewhat poorly drained. It is on flats and in concave swales on uplands. Areas are irregular in shape. They range from 25 to 100 acres on flats and from 2 to 25 acres in the swales.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is light brownish gray, mottled fine sandy loam about 6 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, mottled, firm loam; next is light brownish gray, mottled, firm sandy clay loam; below this is gray, mottled, friable sandy clay loam; and the lower part is yellowish brown, mottled, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, stratified fine sand and fine sandy loam.

Included with this soil in mapping are small areas of Alvin and Bloomfield soils on knolls. Also included are narrow, elongated areas of poorly drained Lyles fine sandy loam at the head of drainageways and in swales and small areas of soils that have more slope or less slope than this Ayrshire soil. The included soils make up about 12 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderately low, and surface runoff is very slow to slow. The surface layer is friable and easy to work through a wide range of soil moisture. Seepage from higher lying soils causes some areas near the base of slopes to be too wet for crops. The seasonal high water table fluctuates between depths of 1 foot and 3 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few areas remain in woodland.

This Ayrshire soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many places. Subsurface drains are commonly used, but outlets are difficult to find. Special blinding materials are needed to prevent fine sand from filling the drains. Land smoothing and shallow surface drains help remove excess surface water. Returning crop residue to the soil, growing cover crops and green manure crops, and conservation tillage help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes depends on completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Some areas can be used for grasses and legumes without drainage, but drainage is generally beneficial. Overgrazing and grazing when the soil is too wet cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. The concerns in management of woodlands are slight.

This soil is severely limited for building sites because of wetness. Installing subsurface drains at the base of footings helps overcome the wetness. Frost action is a severe limitation for local roads and streets. Providing adequate drainage along roads and replacing or strengthening the base materials with a more suitable material to support vehicular traffic lower the possibility of frost action. Wetness is a severe limitation for septic tank absorption fields. This concern can be reduced by installing subsurface drains around the outer edges of the absorption field to remove excess wetness.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

BdF—Berks-Gilpin complex, 30 to 70 percent slopes. These soils are steep and very steep, moderately deep, and well drained. They are on uplands in draws and on breaks adjacent to bottom lands. Berks channery silt loam is typically on the middle part of side slopes. Gilpin silt loam is typically on the convex upper side slopes or shoulder slopes and concave foot slopes. Areas range from about 5 to 75 acres. Slopes are about 40 to 200 feet long, and local relief ranges from about 25 to 100 feet. This complex is about 40 percent Berks channery silt loam, 35 percent Gilpin silt loam, and 25 percent other soils.

Typically, the surface layer of the Berks soil is very dark grayish brown channery silt loam about 3 inches thick. The subsurface layer is yellowish brown channery loam about 4 inches thick. The subsoil is yellowish brown, friable channery and very channery loam about 25 inches thick. The substratum to a depth of about 38 inches is yellowish brown very channery loam. Below this is interbedded fractured sandstone and shale bedrock.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 4 inches thick.

The subsoil is yellowish brown, friable silt loam and channery loam about 22 inches thick. The substratum to a depth of about 35 inches is yellowish brown channery loam. Below this is interbedded fractured sandstone and shale bedrock. In a few places, the slope is less than 30 percent.

Included with these soils in mapping are areas of deep, well drained Hickory soils on the upper convex part of side slopes and on narrow ridgetops between draws; areas of deep, well drained Wellston soils on the convex part of upper side slopes, concave foot slopes, and narrow ridgetops between draws; and strips of somewhat poorly drained Stendal soils in narrow bottoms along drainageways in draws. Also included are small areas of nearly vertical escarpments where faces of sandstone bedrock are exposed. Large sandstone fragments are on the surface in some areas. The included soils make up about 25 percent of mapped areas.

In these soils permeability and organic matter content of the surface layer are moderate. In the Berks soil, available water capacity is low, and surface runoff is very rapid. Sandstone fragments throughout restrict the development of roots and the amount of moisture available for plant growth. In the Gilpin soil, available water capacity is moderate, and surface runoff is very rapid. Both soils are subject to erosion if the woods are cleared and the soil is exposed.

Nearly all areas of these soils are used for woodland.

These soils are not suited to cultivated crops because of the severe erosion hazard and slope. The steep or very steep slopes severely hinder the use of farm machinery.

Grasses and legumes grown for hay or pasture are generally not suited to these Berks and Gilpin soils. The steep or very steep slopes severely hinder the use of tillage and harvesting machinery. Grazing should be restricted in wooded areas that are included in pasture to prevent exposure of the soil and subsequent erosion.

These soils are suited to trees. The trees are mainly native hardwoods, predominantly oaks. The main concerns in management of woodlands are erosion hazard, equipment limitations, seedling mortality, and plant competition. Proper management of ground cover helps reduce erosion. Planting and logging equipment are restricted by slopes. Slopes are short, and equipment operations are mainly on adjacent ridgetops and bottom lands. Competing vegetation can be controlled by cutting, spraying, or girdling.

These soils are severely limited and generally are not suitable for building sites and sanitary facilities because of slope. They are severely limited for roads because of slope. Cutting and filling are needed, and roads should be built on the contour. Areas disturbed during construction should be revegetated during or soon after construction.

These soils are in capability subclass VIIe. The woodland suitability subclass is 3f for the Berks soil and 2r for the Gilpin soil.

BmD—Bloomfield loamy fine sand, 12 to 18 percent slopes. This soil is strongly sloping, deep, well drained and somewhat excessively drained. It is on knolls, on uplands, and on narrow breaks to bottom lands. Areas range from 3 to 30 acres.

Typically, the surface layer is brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown loamy fine sand about 8 inches thick. The subsoil is about 58 inches thick. The upper part is dark brown, very friable loamy sand; below this is yellowish brown, very friable loamy fine sand with dark brown, fine sandy loam bands; and the lower part is nearly continuous bands of brown, very friable loamy fine sand with interbands of yellowish brown fine sand. The substratum to a depth of about 80 inches is brown fine sand. In places, the subsoil has more clay than in the typical profile.

Included with this soil in mapping are small areas of Ayrshire soils on narrow ridgetops. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is moderately rapid to rapid. The organic matter content of the surface layer is moderately low, and surface runoff is medium. This soil is very friable and easy to work when moist. When the soil is dry, it is loose, and traction is poor for tillage equipment.

Most areas of this soil that are included in fields with less sloping soils are used for corn, soybeans, wheat, and hay.

This Bloomfield soil is generally not suited to cultivated crops because of slope, droughtiness, and the hazard of damaging surface runoff and erosion. It should be tilled only when necessary for reseeding grasses and legumes.

Grasses and legumes grown for hay and pasture effectively control erosion and soil blowing. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees, and a few areas remain in woodland. Erosion hazard, equipment limitations, and seedling mortality are management concerns. Erosion is a hazard if the vegetative cover is disturbed. Logging operations are hindered by slopes. Logging roads should be constructed on the contour. Some replanting may be necessary because of the droughtiness on this sandy soil during the dry season.

This soil is severely limited for building sites and for local roads and streets because of slope. Designing and locating buildings to complement the slope, constructing local roads on the contour, and shaping of land help overcome this limitation. Disturbed areas should be revegetated during or after construction so that erosion can be held to a minimum. This soil is severely limited

for septic tank absorption fields because of strong slopes and poor filtering qualities of the soil. Seepage of effluent into nearby shallow wells may become a problem. Installing the absorption field on the contour helps to overcome the slope.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

BmF—Bloomfield loamy fine sand, 25 to 50 percent slopes. This soil is steep and very steep, deep, and well drained or somewhat excessively drained. It is on uplands, on concave breaks in draws, and on narrow breaks to bottom lands. Areas are narrow and elongated and range from 2 to 25 acres.

Typically, the surface layer is very dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is yellowish brown loamy fine sand about 16 inches thick. The subsoil is mainly strong brown, very friable loamy fine sand about 50 inches deep. The substratum to a depth of about 74 inches is yellowish brown fine sand with a few, strong brown loamy fine sand and fine sandy loam bands. In places, sandy clay loam bands are in the subsoil, or the upper part of the subsoil is sandy loam. In a few places, slopes are more than 50 percent.

Included with this soil in mapping are areas of well drained Hickory soils that are on the lower part of the slope in draws and formed in glacial till. Narrow strips of somewhat poorly drained Stendal soils are along drainageways in many draws. The included soils make up about 15 percent of mapped areas.

Available water capacity is moderate, and permeability is moderately rapid to rapid. Organic matter content of the surface layer is moderately low, and surface runoff is rapid. The surface layer is very friable and easy to work when moist. When dry, the soil is loose, and traction is poor for machinery.

Most areas of this soil are used for woodland, and the vegetation is mainly native hardwoods. A few areas are used for pasture.

This Bloomfield soil is not suited to corn, soybeans, or small grain because of droughtiness, the erosion hazard, and slope. The steep and very steep slopes severely hinder the use of farm machinery.

Grasses and legumes grown for pasture are generally not suited to this soil. This soil is not suitable for hayland. The steep and very steep slopes hinder tillage and the use of harvesting machinery. Grazing should be restricted in wooded areas that are included in pastureland to prevent damage to the vegetative cover and subsequent erosion.

This soil is suited to trees. The hazard of erosion, equipment limitations, and seedling mortality are concerns of management. Where plant cover is disturbed, erosion becomes a problem. Logging operations are hindered by the short, steep slopes. Equipment operations are mainly on adjacent ridgetops and bottom lands. Some replanting may be necessary because of droughtiness in this sandy soil during the dry season.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of slope. The slope is a severe limitation to local roads. Cutting and filling are needed, and roads should be built on the contour where possible. Providing adequate side ditches and culverts help prevent excessive erosion. Areas disturbed in construction should be revegetated during or soon after construction.

This soil is in capability subclass VIIs and woodland suitability subclass 3s.

Bo—Bonnie silt loam, frequently flooded. This soil is nearly level, deep, poorly drained and very poorly drained. It is on broad bottom lands. Areas are irregular in shape and range from 100 to 800 acres.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The upper part of the substratum is light brownish gray, mottled silt loam, and the lower part to a depth of about 60 inches is light gray, mottled silt loam. Layers of fine sandy loam and loamy fine sand are in the lower part of the substratum in places.

Included with this soil in mapping are bands of somewhat poorly drained Stendal soils near drainageways and a few areas of poorly drained and very poorly drained Zipp soils that are higher in clay and in small swales. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderately low, and surface runoff is slow or ponded. The surface layer is friable and easy to work but tends to puddle and crust after heavy rains. The seasonal high water table is at or near the surface in winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for small grain, or for grasses and legumes for hay and pasture. A few areas remain in woodland.

This Bonnie soil is suited to corn and soybeans. Wetness is the main limitation. Flooding is a hazard, and crops need to be replanted in some years because of flooding. Dikes and levees are commonly used to prevent flooding of crops. Subsurface drains have been installed in many areas; however, additional drainage is needed in many places. In places, outlets are difficult to find, and drainage ditches are needed. Land smoothing and shallow surface drains help improve the runoff of excess surface water. Conservation tillage that returns protective crop residue to the surface and the use of cover crops and green manure crops help improve the organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. The legume selection depends on completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of frost heaving.

Selected species of grasses and legumes can be grown without drainage, but drainage is generally beneficial. Proper stocking rates, restricted grazing during wet periods, pasture rotation, and timely grazing help keep the pasture and soil in good condition. Erosion commonly results when livestock damages the vegetative cover on streambanks.

This soil is suited to trees. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations, and planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because it is subject to flooding. The flooding, wetness, and low strength are severe limitations for local roads. Replacing the low strength layers of this soil with suitable soil material, constructing roads on raised, well compacted fill material, and providing adequate side ditches and culverts help overcome the flooding and provide the necessary support for vehicular traffic.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Ca—Chagrin silt loam, occasionally flooded. This soil is nearly level, deep, and well drained. It is on broad bottom lands. Areas are irregular in shape and mainly range from 40 to 250 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is brown, friable silt loam in the upper part and dark yellowish brown, friable silt loam in the lower part. The substratum to a depth of 60 inches is yellowish brown fine sandy loam with thin strata of loamy fine sand and loam. In places, the substratum below a depth of 30 inches is fine sand. The surface layer is loam in areas near streams or drainageways and swales.

Included with this soil in mapping are small, elongated strips of well drained Stonelick soils near streams, drainageways, or swales, where sandy alluvium has been deposited. Narrow, elongated areas of somewhat poorly drained Shoals soils are in small swales and meander channels. The included soils make up about 12 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is slow. The surface layer is friable and easy to till through a wide range of soil moisture. The seasonal high water table is at a depth of 4 to 6 feet.

Most areas of this soil are used for cultivated crops. A few areas are used for small grain, hay and pasture, or remain in woodland.

This Chagrin soil is suited to corn and soybeans. Occasional flooding is a hazard. Occasionally, wheat is damaged by flooding in winter and early in spring and requires replanting. Dikes and levees help prevent flooding of crops during the growing season. Conservation tillage that leaves protective crop residue on the surface and winter cover crops help maintain organic matter content and improve tilth.

This soil is suited to grasses and legumes for hay and pasture but is seldom used for that purpose. Alfalfa is occasionally damaged by flooding in winter and spring. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

Trees are well suited, but this soil is seldom used for wood crops. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of flooding. The flooding is a severe limitation for local roads. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect them from flooding and provide the necessary support for vehicular traffic.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

Cb—Chagrin-Stonelick complex, occasionally flooded. These soils are nearly level, deep, and well drained. They are on broad bottom lands. These soils formed inside the bends of streams that have changed course and built a series of sandbars in the bottom land. Medium textured, more recent alluvium has partially filled in the swales between the sandbars. Alternating, narrow, parallel strips of Chagrin silt loam are in the swales, and Stonelick fine sandy loam is on the low rises. Areas range from about 30 to 200 acres. Strips of Chagrin silt loam range from 50 to 200 feet wide, and strips of Stonelick fine sandy loam range from 50 to 100 feet wide. Swales are typically 1 foot to 3 feet deep. This complex is about 50 percent Chagrin silt loam, 35 percent Stonelick fine sandy loam, and 15 percent other soils.

Typically, the surface layer of the Chagrin soil is dark brown silt loam about 7 inches thick. The upper part of the subsoil is friable, dark brown silt loam about 10 inches thick, and the lower part is friable, dark yellowish brown loam about 13 inches thick. The upper part of the substratum is dark yellowish brown fine sandy loam about 20 inches thick, and the lower part to a depth of about 60 inches is yellowish brown loamy fine sand with thin bands of fine sandy loam and fine sand.

Typically, the surface layer of the Stonelick soil is brown fine sandy loam about 8 inches thick. The upper part of the substratum is brown fine sandy loam; next is yellowish brown loamy fine sand; and the lower part to a depth of 60 inches is yellowish brown, stratified fine sand

and very fine sand with bands of fine sandy loam and loamy fine sand.

Included with these soils in mapping are narrow, elongated areas of moderately well drained Lobdell soils in small swales and meander channels. Also included are soils between swales that have loamy fine sand in the upper part of the profile and fine sand in the lower part. The included soils make up about 10 percent of mapped areas.

In the Chagrin soil permeability is moderate, organic matter content of the surface layer is moderate, available water capacity is high, and surface runoff is slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is below a depth of 4 feet.

In the Stonelick soil permeability is moderately rapid, organic matter content of the surface layer is moderately low, available water capacity is moderate, and surface runoff is slow. The surface layer is very friable and easy to work through a wide range of soil moisture. The seasonal high water table is more than 6 feet deep.

Most areas of these soils are used for cultivated crops.

These soils are suited to corn and soybeans. Wheat and alfalfa are subject to damage from flooding in winter and early in spring. In some years crops must be replanted because flooding has destroyed stands. In places, dikes and levees help prevent flooding. Conservation tillage that leaves crop residue on the surface and winter cover crops help maintain organic matter content and improve tilth and help prevent soil blowing on Stonelick soils. The Stonelick soils and included areas of sandy soils are somewhat droughty. In seasons of below normal or poorly distributed rainfall, crops are subject to damage from drought. A permanent cover of grasses, shrubs, or trees helps prevent scour damage on streambanks (fig. 4).

Grasses and legumes grown for hay and pasture are well suited to these soils. In some years, stands are damaged by flooding. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

These Chagrin and Stonelick soils are well suited to trees. The main management concern is plant competition. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

These soils are severely limited and are generally not suitable for building sites and sanitary facilities because they are subject to flooding. The flooding is a severe limitation for roads. Constructing roads on raised, well compacted fill material and providing adequate side

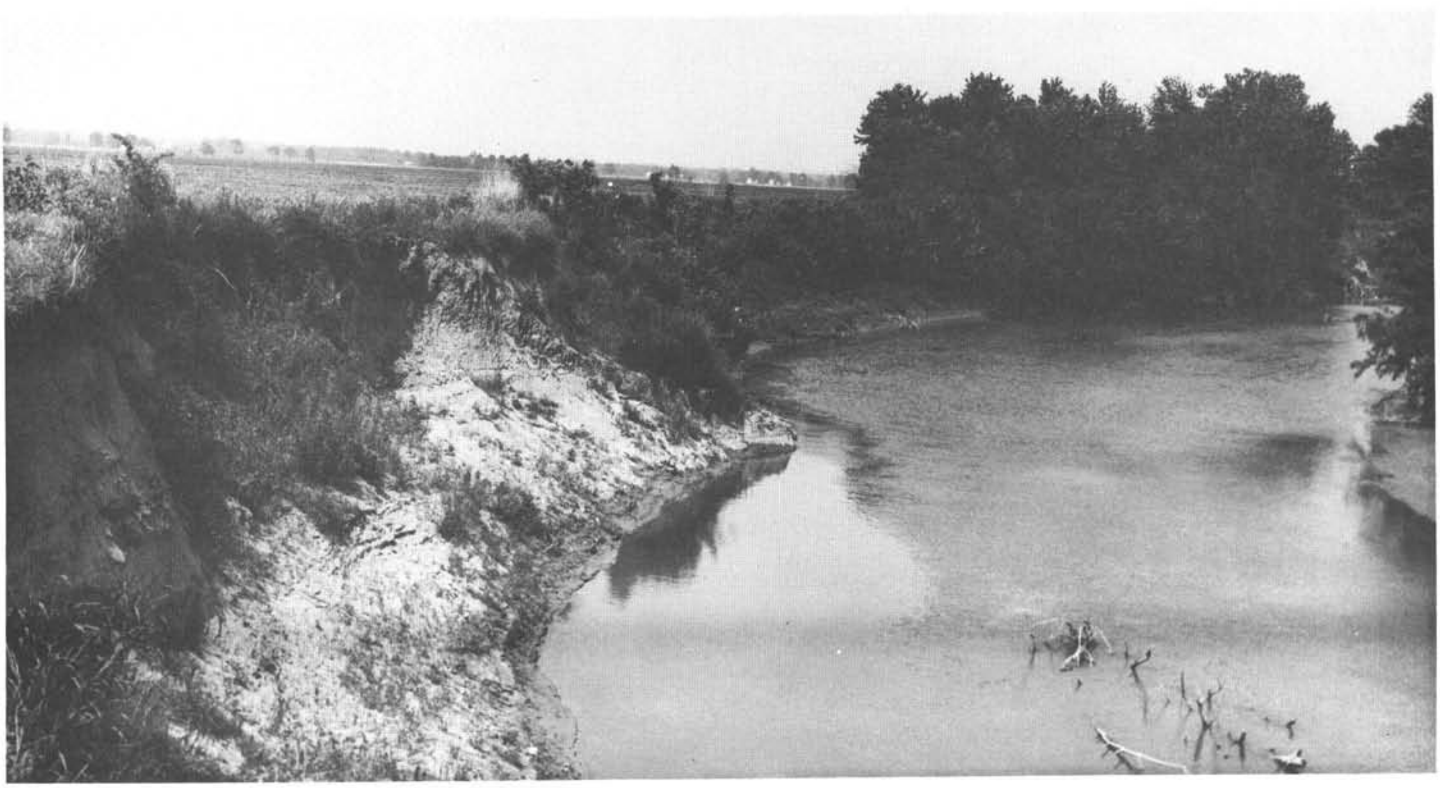


Figure 4.—Sloughing of a streambank along the Eel River. Trees and shrubs have protected the streambank in the background. The soil is Chagrin-Stonelick complex, occasionally flooded.

ditches and culverts help protect the roads from flooding.

These soils are in capability subclass IIw. The woodland suitability subclass is 1o for the Chagrin soil and 2o for the Stonelick soil.

CcC2—Cincinnati silt loam, 6 to 12 percent slopes, eroded. This soil is moderately sloping, deep, and well drained. It is on uplands on concave breaks or side slopes along drainageways and convex knolls and ridges between steeply sloping draws. The areas along drainageways are generally narrow and elongated and range from 3 to 20 acres; the areas on knolls are irregular in shape and range from 2 to 10 acres. Slopes are mainly 50 to 150 feet long.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is pale brown silt loam about 3 inches thick. The subsoil is yellowish brown, friable silt loam in the upper part; next is yellowish brown, firm silty clay loam; below this is a yellowish brown, mottled, very firm, brittle fragipan of silt loam over clay loam; and the lower part is yellowish brown and strong brown, mottled, firm clay loam to a depth of 82 inches.

In places areas of this soil formed in 40 to 60 inches of loess. Small areas are severely eroded, and the surface layer is mainly yellowish brown silt loam subsoil material. The fragipan is weak on some knolls and ridges and where glacial till is thin over bedrock. The substratum in areas of Cass and Washington Townships consists of residuum from sandstone and shale. Areas in woods are not eroded and have a very dark grayish brown or dark brown surface layer 2 to 4 inches thick. Small areas of gently sloping, moderately well drained soils that are similar to this Cincinnati soil are on narrow, elongated ridgetops.

Included with this soil in mapping are small, narrow, elongated bands of somewhat poorly drained Stendal soils in the bottom of draws. Also included are areas of soils that have slightly more slope and areas that have slightly less slope. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is slow. The fragipan is restrictive to water movement and the growth of plant roots. The organic matter content is moderate, and surface runoff is rapid. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is below a depth of 4 feet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and some areas are in woodland.

This Cincinnati soil is suited to corn, soybeans, and small grain. Erosion and runoff are hazards on this soil, and the fragipan limits the available water capacity. Crop rotations that include grasses and legumes help control erosion. Terraces and contour farming help prevent erosion in areas where slopes are long and uniform. Grassed waterways, basin terraces, and grade stabilization structures help prevent gullying. Conservation tillage that leaves protective crop residue on the surface, and the use of cover crops and green manure crops help prevent erosion, maintain organic matter content, and improve tilth. The fragipan restricts root development and causes a perched water table. Farming operations are commonly delayed by the resulting seepage on slopes. Subsurface drains can be used to intercept seepage on slopes and to drain the included Stendal soils in the bottom of draws.

Grasses and many legumes grown for hay and pasture are well suited to this soil. Alfalfa and other deep-rooted crops are not well suited because the fragipan restricts root and water penetration. Hay and pasture effectively control runoff and erosion (fig. 5). Overgrazing and trampling by livestock when the soil is wet cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees. The use of this soil for woodland is effective in helping to control erosion. The main management concerns are seedling mortality, windthrow hazard, and plant competition. Replanting of some seedlings is generally needed. Care in thinning helps overcome the windthrow hazard. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

This soil is moderately limited for building sites dominantly because of slope. Designing buildings to complement the slope, shaping the land, and installing retaining walls help overcome this limitation. Areas disturbed in construction should be revegetated during or soon after construction. Wetness is a problem for buildings with basements. Installing drains at the base of footings helps lower the water table. Frost action and low strength are severe limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help to overcome low strength and frost action. Slow permeability is a severe limitation for septic tank absorption fields. This limitation can be reduced by excavating the slowly permeable material and replacing it with more permeable material and installing subsurface drains around the outer edges of the absorption field to remove excess wetness. Installing the absorption field on the contour helps overcome the moderate slope.

This soil is in capability subclass IIIe and woodland suitability subclass 2d.

CcC3—Cincinnati silt loam, 6 to 12 percent slopes, severely eroded. This soil is moderately sloping, deep,

and well drained. It is on uplands on concave breaks or side slopes along drainageways and convex knolls and ridges between steeply sloping draws. The areas along drainageways are generally narrow and elongated and range from 3 to 40 acres. The areas on knolls are irregular in shape and range from 2 to 20 acres. Slopes are mainly 50 to 150 feet long.

Typically, the surface layer is yellowish brown silt loam about 7 inches thick. The subsoil is about 61 inches thick. The upper part is yellowish brown, friable and firm silt loam and silty clay loam; below this is a yellowish brown, mottled, very firm clay loam and loam fragipan that is brittle when dry; the lower part is yellowish brown, mottled, friable loam. The substratum to a depth of about 80 inches is yellowish brown clay loam.

In some areas this soil formed in 40 to 50 inches of loess. Small areas of soils that are on tops of knolls and narrow ridges and are not severely eroded have a surface layer mainly of brown silt loam. The fragipan is at a depth of 12 to 18 inches in places. Where the glacial till is thin over bedrock in parts of areas in Cass and Washington Townships, the lower part of the subsoil and the substratum formed in residuum from sandstone and shale. Some narrow, elongated areas on ridgetops have slopes of 2 to 6 percent and are not eroded.

Included with this soil in mapping are narrow, elongated areas of somewhat poorly drained Stendal soils in the bottom of draws. A few gullies are present in some areas. Also, areas of soils that have slightly more slope or slightly less slope are included. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is slow. The fragipan is restrictive to water movement and the growth of plant roots. The organic matter content is low, and surface runoff is rapid. The surface layer is somewhat sticky when wet; it is hard and cloddy

Figure 5.—Hayland in an area of Cincinnati silt loam, 6 to 12 percent slopes, eroded. Large hay bales are convenient to handle with farm machinery.

when dry. The seasonal high water table is below a depth of 4 feet.

Most areas of this soil are used for cultivated crops. Some areas are used for hay and pasture, and a few areas have been planted to pine trees.

This Cincinnati soil is poorly suited to corn, soybeans, and small grain because of the hazard of erosion. The fragipan limits the available water capacity of this soil. Crop rotations that include grasses and legumes most of the time help control erosion. Where slopes are long and even, terraces and contour farming help prevent excessive soil loss. Grassed waterways, water and sediment control basins, and grade stabilization structures help prevent gullying. Conservation tillage, leaving crop residue on the surface, and using cover crops and green manure crops in the cropping system help prevent erosion, maintain organic matter content, and improve tilth. The fragipan restricts root development and causes a perched water table. Farming operations are commonly delayed by the resulting seepage on slopes. Subsurface drains intercept the seepage and help to drain the included Stendal soils in the bottom of draws.

Grasses and legumes grown for hay and pasture on this soil effectively control runoff and erosion. Alfalfa and other deep-rooted crops are not well suited because the fragipan restricts roots and water penetration. Overgrazing and trampling by livestock when the soil is wet cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely grazing keep the pasture and soil in good condition.

This soil is suited to trees, and a few areas remain in woods. Woodland effectively controls erosion. The main management concerns are seedling mortality, windthrow hazard, and plant competition. Replanting of some seedlings is generally needed. No thinning or care in thinning helps overcome the windthrow hazard. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

This soil is moderately limited for building sites mainly because of slope. Designing buildings to complement the slope, shaping the land, and installing retaining walls help overcome this limitation. Areas disturbed during construction should be revegetated during or soon after construction. Wetness is a problem for dwellings with basements. Installing drains around footings helps lower the water table. Frost action and low strength are severe limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help to overcome low strength and frost action. Slow permeability is a severe limitation for septic tank absorption fields. This limitation can be reduced by excavating the slowly permeable material and replacing it with more permeable material and installing subsurface drains around the outer edges of the absorption field to remove excess wetness. Installing the absorption field on the contour helps overcome the moderate slope.

This soil is in capability subclass IVe and woodland suitability subclass 2d.

CeC3—Cincinnati Variant silt loam, 6 to 12 percent slopes, severely eroded. This soil is moderately sloping, deep, and well drained. It is on concave breaks or side slopes along drainageways and on convex knolls and ridges. Areas are generally narrow and elongated and range from 3 to 30 acres. Slopes are dominantly 50 to 150 feet long.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown and yellowish brown, friable and firm silty clay loam; below this is a yellowish brown, mottled, very firm, brittle, silt loam fragipan; and the lower part is strong brown, firm clay loam to a depth of 80 inches. In places, the substratum is clay or silty clay that formed from decomposed shale. In some areas where soils are on landscape positions similar to those of this Cincinnati Variant, sandstone bedrock is at a depth of 4 to 6 feet.

Included with this soil in mapping are small areas of gently sloping, well drained Pike soils that do not have a fragipan on narrow ridgetops and areas of somewhat poorly drained Stendal or Newark soils along drainageways. Also included are small areas of soils that have more slope or less slope than this soil. The included soils make up about 10 percent of mapped areas.

Available water capacity is moderate, and permeability is very slow. Organic matter content of the surface layer is low, and surface runoff is rapid. The surface layer is cloddy and hard to work when dry and is sticky and puddles easily when wet.

Most areas of this soil are used for cultivated crops or for grasses and legumes for hay and pasture. A few areas are in woodlots.

This Cincinnati Variant soil is poorly suited to cultivated crops, such as corn and soybeans, because of the hazard of excessive runoff and subsequent erosion. It is suited to small grain. Where slopes are uniform and long, terraces, contour farming, and diversions help prevent excessive soil losses in cultivated cropland. Grassed waterways, water and sediment control basins, and grade stabilization structures help prevent gullying. Crop rotations, conservation tillage that leaves protective crop residue on the surface, and the use of cover crops help to control erosion. These practices also help to maintain the organic matter content and improve tilth. The fragipan restricts root development and causes seepage on side slopes. Subsurface drains intercept seepage on slopes and drain the soil in the bottom of draws.

Grasses and legumes grown for hay or pasture on this soil help to control runoff and erosion. Overgrazing causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition. Alfalfa is not well suited because the fragipan restricts root penetration, and frost heaving commonly damages stands.

This soil is suited to trees. In places areas have been planted to trees and other areas have been revegetated naturally from nearby wooded areas. The main management concerns are seedling mortality, windthrow hazard, and plant competition. Replanting of some seedlings is generally needed. No thinning or care in thinning helps overcome the windthrow hazard. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling.

This soil is moderately limited for building sites because of the slope. Designing buildings to complement the slope, shaping the land, and installing retaining walls help to overcome the slope limitation. In places, bedrock limits the depth of excavations and restricts the placement of underground utilities. Areas disturbed during construction should be revegetated during or soon after construction. Frost action and low strength are severe limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help to overcome low strength and frost action. Slow permeability is a severe limitation for septic tank absorption fields. Excavating the slowly permeable material and replacing it with more permeable material reduces the effect of this limitation. Installing subsurface drains around the outer edges of the absorption field removes excess wetness. Installing the absorption field on the contour helps overcome the slow permeability.

This soil is in capability subclass IVe and woodland suitability subclass 2d.

ChF—Chetwynd loam, 25 to 70 percent slopes. This soil is steep or very steep, deep, and well drained. It is on uplands on concave slopes in draws and on breaks to bottom lands. Areas range from 5 to 30 acres. They are mainly narrow and elongated in draws, but in places are irregular in shape where several draws are close together. Slopes are 50 to 150 feet long.

Typically, the surface layer is dark grayish brown loam about 3 inches thick. The subsurface layer is brown loam about 3 inches thick. The upper part of the subsoil is yellowish brown, friable loam; below this is yellowish red, firm sandy clay loam; next is yellowish red and strong brown, friable sandy loam; and the lower part to a depth of 80 inches is strong brown, very friable sandy loam with light yellowish brown, loose, fine sand bands. In small parts of some areas, the surface layer is loamy fine sand. In areas, the soil on lower parts of slopes formed in glacial till.

Included with this soil in mapping are small areas of gently sloping, well drained Pike soils on narrow ridgetops between draws. The Pike soils have a higher content of silt than this Chetwynd soil. Also included are narrow strips of somewhat poorly drained Shoals soils along drainageways in the bottom of many draws. The included soils make up about 25 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is very rapid. The surface layer is friable and easy to work through a wide range of soil moisture.

Nearly all areas of this soil are used for woodland. Small parts of a few areas, however, are used for pasture.

This Chetwynd soil is not suited to corn, soybeans, or small grain because of the severe hazard of erosion and the steep or very steep slopes. The slopes severely hinder the use of farm machinery.

Grasses and legumes grown for hay and pasture are generally not suited to this soil. The steep or very steep slopes severely hinder the use of tillage and harvesting machinery. Grazing needs to be restricted in wooded areas that are included in pastureland to prevent exposure of the soil and subsequent erosion.

This soil is suited to trees. The use of this soil as woodland effectively prevents erosion. The hazard of erosion, equipment limitations, and plant competition are the main concerns of management. Slopes are short, and equipment operations are mainly on adjacent ridgetops and bottom lands. Logging roads should be placed on the contour to minimize erosion. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of slope. The slope is a severe limitation for local roads. Cutting and filling are needed, and roads should be built on the contour where possible. Providing adequate side ditches and culverts helps prevent excessive erosion. Areas disturbed during construction should be revegetated during or soon after construction.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

CoA—Cory silt loam, 0 to 2 percent slopes. This soil is nearly level, deep, and somewhat poorly drained. It is on uplands on broad flats and in shallow depressions at the head of drainageways. Areas are mainly irregular in shape and range from 5 to 160 acres.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 7 inches thick. The subsoil is about 51 inches thick. The upper part is gray, mottled, firm silty clay loam, and the lower part is

light gray, mottled, firm silty clay loam. The substratum to a depth of 70 inches is light gray, stratified silt loam, silty clay loam, and clay loam. A few areas of lighter colored, poorly drained soils are on broad flats. In a few swales, the dark colored surface layer is 10 to 15 inches thick.

Included with this soil in mapping are a few small areas of somewhat poorly drained Iva soils on slight rises and broad flats. The Iva soils have a lighter colored surface layer than this Cory soil. The included soils make up about 8 percent of mapped areas.

Available water capacity is high, and permeability is slow. Organic matter content in the surface layer is high, and surface runoff is slow. The seasonal high water table is at a depth of 1 foot to 3 feet during winter and early in spring. The surface layer is friable and can be easily tilled through a fairly wide range of soil moisture.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture.

This Cory soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Subsurface drains are commonly used, but drainage ditches are needed in some areas to provide outlets for the tile. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help maintain organic matter content and good tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil. The selection of a legume should depend on completeness of drainage. Alfalfa is poorly suited because of wetness and frost heaving. Grazing by livestock when the soil is wet damages the sod and causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees but is seldom used for wood crops. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, and girdling. Water-tolerant species are favored in timber stands. Because this soil developed under prairie grasses, woodland indices are not available.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Local roads and streets are severely limited because of low strength and frost action. Providing adequate drainage along roads and replacing and strengthening the base materials with more suitable material to support vehicular traffic help to overcome the low strength and frost action. Septic tank absorption fields are severely limited because of slow permeability and wetness. The slow permeability can be reduced by excavating the slowly permeable material and replacing it with a more permeable material. Installing subsurface drains around the outer edges of the absorption field removes excess wetness.

This soil is in capability subclass IIw. It is not assigned to a woodland suitability subclass.

Ev—Evansville silt loam, occasionally flooded. This soil is nearly level, deep, and poorly drained. It is on broad, flat slack water terraces. Areas are irregular in shape and range from 50 to 400 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 40 inches thick. The upper part is light brownish gray, mottled, friable silt loam, and the lower part is gray, mottled, firm silty clay loam. The substratum is gray, mottled, stratified silt loam and silty clay loam to a depth of about 60 inches. In some areas, the substratum contains strata of loam and fine sandy loam. The subsoil is strongly acid in places.

Included with this soil in mapping are narrow, elongated areas of poorly drained or very poorly drained Zipp soils in swales. The Zipp soils have a higher content of clay than this Evansville soil. Areas of poorly drained Petrolia soils in swales are also included. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate, and surface runoff is slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture but tends to puddle and crust after heavy rains. The seasonal high water table commonly is at or near the surface during winter and early in spring.

Most areas of this soil are used for cultivated crops.

This Evansville soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Subsurface drains are commonly used, but drainage ditches are needed in many areas to provide outlets. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes should depend on the completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Overgrazing and grazing when the soil is too wet damage the sod, reduce plant densities, reduce forage yields, and cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted grazing during wet seasons help keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitations, seedling mortality, windthrow hazard, and plant

competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations, and the planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because it is subject to flooding. Flooding, frost action, and low strength of the soil are severe limitations for local roads. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material helps to overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help overcome flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

FcB—Fairpoint shaly silt loam, 0 to 8 percent slopes. This soil is nearly level to moderately sloping, deep, and well drained. It is on uplands. Areas consist of partially smoothed mine spoil. Slopes are undulating and mainly 50 to 200 feet long. Many depressional areas have no outlets for surface drainage, and some contain water part of the year. Mine spoil remains after an area has been surface mined for coal and consists mainly of masses of soft shale fragments, moderately fine and medium textured soil, loamy glacial till, and sandstone fragments. Most of the spoil is neutral in reaction, but some small spots are extremely acid, and some areas are mildly alkaline. Most sandstone fragments larger than 6 inches have been buried at least 6 inches deep or have been removed. Areas mainly range from 20 to 600 acres.

Typically, the surface layer is dark grayish brown shaly silt loam about 3 inches thick. The upper part of the underlying material is mottled gray and brown shaly silt loam, and the lower part to a depth of about 60 inches is grayish brown very shaly silty clay loam.

Included with this soil in mapping are narrow, elongated pits that contain water. The sides of many pits are very steep. Also included are a few areas of partially smoothed spoil from underground mines that consist mainly of shale, carbonaceous shale, and low grade coal. The spoil from underground mines is generally extremely acid. In some areas, waste material from coal preparation plants, mainly of coal dust and shale and sandstone fragments, has been covered with 8 to 15 inches of silt loam, silty clay loam, or clay loam. In a few areas the mine spoil has been smoothed and 20 to 36 inches of silt loam, silty clay loam, or clay loam has been spread over the areas. A few large sandstone fragments are on the surface in some places.

Included with this soil in mapping are areas that have slopes of more than 8 percent. The included soils make up about 25 percent of mapped areas.

Available water capacity is moderate, and permeability is moderately slow. Organic matter content of the surface layer is very low, and surface runoff is medium to rapid. The surface layer is friable and easy to work when moist, is somewhat sticky when wet, and becomes hard and cloddy when dry. In parts of mapped areas, sandstone fragments restrict the operation of tillage or excavation equipment and limit the development of roots and the amount of water available for plant growth.

Most areas of this soil are used for pasture or hayland. A few areas are used for cultivated crops or small grain.

This Fairpoint soil is fairly well suited to corn, soybeans, or small grain. Tillage operations are hindered in some areas where sandstone fragments are near the surface of the soil. Erosion is a hazard in parts of map units that have slopes of more than 2 percent. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help reduce runoff and erosion, maintain the organic matter content, and improve tilth.

Grasses and legumes grown for hay and pasture are fairly well suited to this soil. Tillage and harvesting operations are hindered in some areas where sandstone fragments are near the surface. A wide variety of grasses and legumes, including alfalfa, can be grown. The use of this soil for hay and pasture helps control erosion (fig. 6). Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Because this soil developed in mine spoil materials, woodland indices are not available.

This soil is moderately limited for building sites because of shrink-swell of the soil and the presence of large stones. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps prevent structural damage caused by shrinking and swelling of the soil. Large stones are difficult to excavate in places. Differential settling rates are possible because of variation in fill material and compaction during reclamation. Low strength and frost action are moderate limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help to overcome these limitations. Roads may need additional reinforcement to compensate for possible differential settling rates. Disturbed areas should be revegetated during or soon after construction. Septic tank absorption fields are severely limited because of moderately slow permeability. This concern can be reduced by excavating

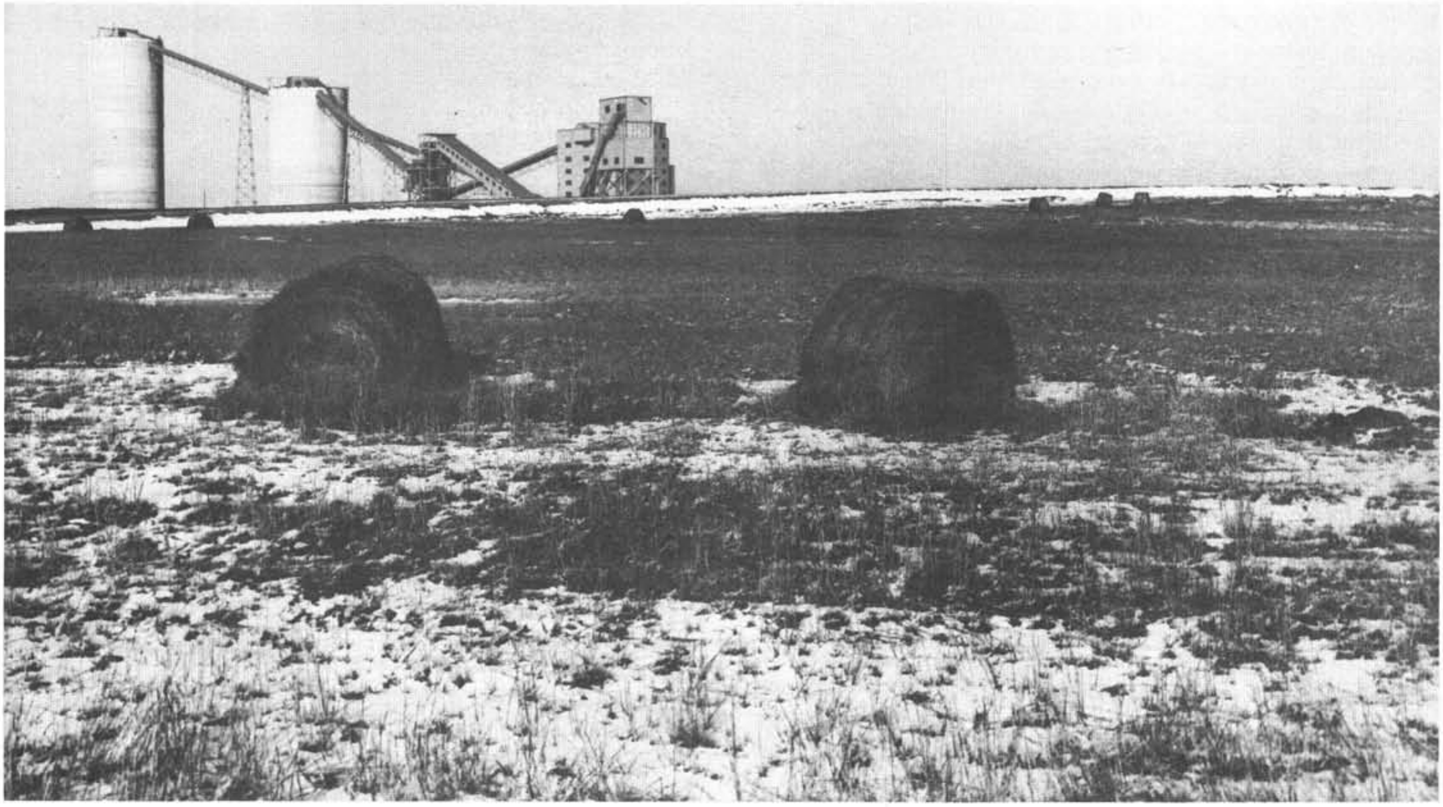


Figure 6.—Hayland in an area of Fairpoint shaly silt loam, 0 to 8 percent slopes. The spoil from surface mining has been smoothed.

the soil material and replacing it with more permeable material.

This soil is in capability subclass IIIe. It is not assigned to a woodland suitability subclass.

FcG—Fairpoint shaly silty clay loam, 33 to 90 percent slopes. This soil is very steep, deep, and well drained. It is on uplands. Areas consist of a series of narrow, elongated mounds about 15 to 40 feet high. The mounds are piles of spoil from surface mining for coal and consist mainly of masses of shale, soil, glacial till, and sandstone (fig. 7). Most areas of spoil are neutral in reaction, but some areas are extremely acid and some are mildly alkaline. Most areas range from 20 to 600 acres.

Typically, the surface layer is very dark gray shaly silty clay loam about 2 inches thick. The upper part of the underlying material is dark gray, very shaly silty clay loam about 22 inches thick, and the lower part is dark gray, partially weathered, soft shale fragments to a depth of about 60 inches. Small areas have slopes of more than 90 percent or less than 33 percent.

Included with this soil in mapping are narrow, elongated pits that contain water. Also included are piles of spoil from underground mines that consist mainly of shale, carbonaceous shale, and low grade coal. Some areas are filled with waste material from coal preparation plants and consist mainly of coal dust and fragments of shale and sandstone. Many large sandstone fragments are on the surface in places. The included soils make up about 20 percent of mapped areas.

Available water capacity is moderate, and permeability is moderately slow. Organic matter content of the surface layer is very low, and surface runoff is very rapid. The upper part of the soil is friable and easy to work through a wide range of soil moisture.

Nearly all areas of this soil are used for woodland. Most areas have heavy forest vegetation, but a few extremely acid areas are nearly bare.

This Fairpoint soil is not suited to cultivated crops because of the severe erosion hazard and slope. The very steep slopes severely hinder the use of farm machinery.

Grasses and legumes grown for hay or pasture are generally not suited to this soil. The steep slopes hinder the use of tillage and harvesting machinery. In places, this soil is in areas of pasture. In these places, the vegetation is mainly mixed trees, weeds, shrubs, and grasses. Generally, pasture is not improved unless the spoil is partially smoothed so that farm equipment can be used.

This soil is suited to trees. The trees are mainly pine, locust, cottonwood, and sycamore. The very steep slopes hinder the use of planting and logging equipment. Because this soil developed in mine spoil materials, woodland indices are not available. Onsite evaluation is needed to determine the tree species to plant and the management needed (fig. 8).

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of steep slopes and soil slippage. The steep slopes and soil slippage are also severe limitations for local roads. Cutting and filling are necessary in the construction of roads, even when built on the contour. Large volumes of earth can slip in excavations on steep slopes or in soil material saturated with water and associated with zones of weakness. This soil material does not have the cohesiveness of natural soils; therefore, special precautions are needed to prevent soil slippage in road construction.

This soil is in capability subclass VIIe. It is not assigned to a woodland suitability subclass.

GmE—Gilpin-Wellston silt loams, 18 to 30 percent slopes. These soils are moderately steep or steep and

Figure 7.—A cut in Fairpoint shaly silty clay loam, 33 to 90 percent slopes, shows layers of yellowish brown soil material interspersed with layers of dark gray soft shale fragments.

Figure 8.—Deciduous trees and pine trees on Fairpoint shaly silty clay loam, 33 to 90 percent slopes.

moderately deep or deep. They are on uplands in draws and on breaks to adjacent bottom lands. Gilpin silt loam is typically on the middle, convex part of side slopes. Wellston silt loam is typically on the convex, upper part of side slopes and concave toe slopes. Areas range from about 5 to 100 acres. Slopes are about 50 to 150 feet long, and local relief ranges from 15 to 50 feet. This complex is about 50 percent Gilpin silt loam, 30 percent Wellston silt loam, and 20 percent other soils.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 2 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is yellowish brown, friable channery loam about 29 inches thick. The substratum to a depth of about 40 inches is yellowish brown, mottled very channery silt loam. Below this is interbedded fractured sandstone and shale bedrock.

Typically, the surface layer of the Wellston soil is very dark grayish brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, firm silty clay loam. The substratum to a depth of about 54 inches is yellowish brown loam. Below this is interbedded fractured sandstone and shale bedrock. In a few places, slopes are less than 18 percent or more than 30 percent.

Included with these soils in mapping are areas of well drained Berks soils that are high in content of coarse fragments and on very steep, convex side slopes; strips of gently sloping, well drained Pike soils that overlie glacial outwash and are on narrow ridgetops between draws; and strips of somewhat poorly drained Stendal soils in narrow bottoms along drainageways in draws. Also included are a few small areas of nearly vertical escarpments where sandstone bedrock is exposed. A few large sandstone fragments are on the surface in

some areas. The included soils make up about 20 percent of mapped areas.

The Gilpin soil is moderately permeable. The organic matter content of the surface layer is moderate. Available water capacity is moderate. Surface runoff is rapid or very rapid. This soil is subject to erosion if the forest is cleared and the soil is exposed. The Wellston soil is moderately permeable. The organic matter content of the surface layer is moderate. The available water capacity is high. Surface runoff is rapid. This soil is subject to erosion if the forest is cleared and the soil is exposed.

Most areas of these soils are used for woodland. Parts of some areas have been cleared and are used for permanent pasture.

These Gilpin and Wellston soils are generally not suited to corn, soybeans, or small grain because of the steepness of slope and the hazard of damaging surface runoff and erosion.

Grasses and legumes grown for pasture help control runoff and erosion. The slopes hinder the use of farm machinery. Grazing should be limited to prevent damage to the stand and exposure of the soil, which can result in damaging erosion.

These soils are suited to trees. The trees are mainly native hardwoods, predominantly oaks. The main concerns in management of woodlands are erosion hazard, equipment limitations, and plant competition. Proper management of ground cover, placing logging roads on the contour, and timely use of equipment when the topsoil is dry and firm help reduce erosion. Planting and logging equipment are restricted by slopes. Slopes are short and equipment operations are mainly on adjacent ridgetops and bottom lands. Competing vegetation can be controlled by cutting, spraying, or girdling.

These soils are severely limited and generally not suitable for building sites and sanitary facilities because of slope. Also, the depth to bedrock is of concern on the Gilpin soils. The steep slopes are severe limitations for local roads. Constructing roads on the contour and landshaping help overcome the slope limitation. Frost action is an additional problem on the Wellston soil. The upper soil layers need to be replaced or covered with suitable base material. Areas disturbed during construction should be revegetated during or soon after construction.

These soils are in capability subclass VIe and woodland suitability subclass 2r.

HbA—Henshaw silt loam, 1 to 3 percent slopes. This soil is nearly level and gently sloping, deep, and somewhat poorly drained. It is on low stream terraces at breaks to bottom lands and on the sides of drainageways. Areas are narrow and elongated. Most areas range from 5 to 35 acres. Slopes are mainly 75 to 150 feet long.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsurface layer is pale brown, mottled silt loam about 6 inches thick. The subsoil is about 47 inches thick. The upper part is pale brown, mottled, friable silt loam; below this is mottled, yellowish brown and light brownish gray, firm silt loam; next is light brownish gray, mottled, firm silt loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 70 inches is yellowish brown, mottled, stratified silt loam and silty clay loam. A weak fragipan is present in places.

Included with this soil in mapping are small areas of soils on breaks. These soils have slopes of 2 to 4 percent, are moderately well drained, and have a brighter colored subsoil than this Henshaw soil. Narrow strips of frequently flooded, somewhat poorly drained Stendal soils are along drainageways in draws. The included soils make up about 15 percent of mapped areas.

Available water capacity is high, and permeability is moderately slow. The organic matter content is moderate, and surface runoff is slow or medium. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is at a depth of 1 foot to 2 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for grasses and legumes for hay or pasture or are in woodland.

This Henshaw soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Erosion is a hazard on slopes of 2 to 4 percent. Subsurface drains are in many areas. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content, maintain good tilth, and prevent erosion.

Grasses and legumes grown for hay and pasture are well suited to this soil. The selection of legumes should depend on completeness of drainage. Deep-rooted legumes are not so well suited as shallow-rooted crops. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely grazing, and restricted use during wet periods help reduce surface compaction, maintain good tilth, and increase plant density.

This soil is suited to trees but is seldom used for wood crops. Equipment limitations, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations. Species that tolerate wet conditions are favored in timber stands. Seedlings survive and grow fairly well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Low strength and frost action are severe limitations for local roads and streets. Providing

adequate drainage along roads and replacing and strengthening the base material with more suitable material to support vehicular traffic help overcome these limitations. Slow permeability and wetness are limitations for septic tank absorption fields. The limitation of slow permeability can be reduced by excavating the slowly permeable material and replacing it with more permeable material. Installing subsurface drains around the outer edges of the absorption field removes excess wetness.

This soil is in capability subclass IIw and woodland suitability subclass 1w.

HcD—Hickory silt loam, 12 to 18 percent slopes. This soil is strongly sloping, deep, and well drained. It is on the sides of draws on uplands and on breaks between the upland and bottom land. Areas are narrow and elongated and mainly range from 5 to 30 acres. Slopes are 40 to 150 feet long.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The upper part of the subsoil is yellowish brown, friable or firm silt loam; below this is yellowish brown, firm or very firm clay loam; and the lower part to a depth of 80 inches is yellowish brown, friable clay loam. In places in eroded areas, the surface layer is yellowish brown silt loam. A yellowish brown, moderately alkaline, loam substratum is below a depth of 60 inches in places. A soil with a fragipan is present in some areas. Slopes are less than 12 percent in a few areas. In places in Cass and Washington Townships, the lower part of the subsoil and the substratum formed in residuum from sandstone and shale bedrock. In these places, fractured sandstone and shale bedrock is below a depth of 5 to 10 feet.

Included with this soil in mapping are elongated areas of gently sloping, well drained Cincinnati soils on narrow ridgetops between draws. These soils have a fragipan. Narrow strips of somewhat poorly drained Newark and Stendal soils that are less than 50 feet wide are in the bottom of draws. The included soils make up about 15 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate, and surface runoff is rapid. The surface layer is friable and easy to work.

Most areas of this soil are in woodland. Some areas have been cleared and are used for grasses and legumes for hay or pasture. Parts of a few areas that are in fields with less sloping soils are used for cropland.

This Hickory soil is generally not suited to corn or soybeans because of slope and the hazard of erosion. It is suited to small grain. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops help prevent erosion in cropland. Grasses and legumes should be tilled only when reseeding. Grassed waterways and grade stabilization structures help prevent gullying in draws.

Grasses and legumes grown for hay and pasture are well suited to this soil. Overgrazing causes surface compaction and excessive runoff, which commonly results in erosion. Proper stocking rates, pasture rotation, and timely grazing help keep pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of slope and moderate shrink-swell. Designing buildings to complement the slope; strengthening foundations, footings, and basement walls; and backfilling with coarser material help prevent structural damage caused by shrinking and swelling. Areas disturbed during construction should be revegetated during or soon after construction.

Low strength is a moderate limitation for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help overcome the low strength. Moderate permeability and slope are moderate limitations for septic tank absorption fields. The effects of slow permeability can be reduced by excavating the slowly permeable material and replacing it with more permeable material. Installing the absorption field on the contour helps to overcome the slope limitation.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

HcD3—Hickory silt loam, 12 to 18 percent slopes, severely eroded. This soil is strongly sloping, deep, and well drained. It is on the side slopes of natural drainageways and on breaks between the upland and bottom land. Areas are narrow, elongated, and mainly range from 3 to 40 acres. Slopes are irregularly shaped and about 40 to 150 feet long.

Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is yellowish brown. The upper part is friable, silt loam; below this is firm and friable clay loam; and the lower part to a depth of about 80 inches is friable loam. In places areas that are less eroded have a brown or dark brown, silt loam surface layer. In places in Cass and Washington Townships, the lower part of the subsoil and the substratum formed in residuum from sandstone and shale bedrock. In these places, fractured sandstone and shale bedrock is below a depth of 5 to 10 feet. In places, a fragipan is in the subsoil.

Included with this soil in mapping are narrow, elongated strips of somewhat poorly drained Newark soils along drainageways at the bottom of draws. Small areas of gently sloping, well drained Pike soils that are underlain by glacial outwash and moderately well drained Ava soils are on narrow ridgetops between draws. The

included soils make up about 15 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is low, and surface runoff is very rapid. The surface layer is cloddy when dry, and a seedbed is difficult to prepare.

Many areas of this soil are used for grasses and legumes for hay and pasture. The potential for this use is good. Many areas are included in fields that have less sloping soils and are used for corn, soybeans, and small grain. Parts of a few areas are in woodlots.

This Hickory soil is generally not suited to cultivated crops, such as corn and soybeans, because of the hazards of surface runoff and erosion. The soil should be tilled only when grasses and legumes need reseeding. In most areas, slopes are so short and uneven that terraces, diversions, and contour farming are not practical. Grassed waterways and grade stabilization structures help prevent gullying in draws. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops help prevent erosion in cropland. Seedbeds are difficult to prepare because of the cloddy condition of the plow layer.

Grasses and legumes grown for hay and pasture help control runoff and erosion. Overgrazing and grazing when the soil is too wet cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees, and in places areas have been reforested by natural seeding or by planting trees. The hazard of erosion, equipment limitations, and plant competition are the main management concerns. Proper management of ground cover, placing logging roads on the contour, and timely use of equipment when the topsoil is dry and firm help reduce erosion. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites and septic tank absorption fields because of strong slopes. Designing buildings to complement the slope, shaping land, and installing retaining walls are required in places. Disturbed areas should be revegetated during or soon after construction. Land shaping and installing the distribution lines of septic tanks across the slope generally are necessary for proper functioning of absorption fields. Slope and low strength are severe limitations for local roads and streets. Constructing local roads and streets on the contour and shaping the land help overcome the slope limitation. The base material for roads can be strengthened by replacing the material with more suitable material.

This soil is in capability subclass VIe and woodland suitability subclass 1r.

HcE—Hickory loam, 18 to 25 percent slopes. This soil is moderately steep, deep, and well drained. It is on uplands on concave breaks in draws and on side slopes along ridges and knolls. Most areas range from 3 to 30 acres and are narrow and elongated. Slopes mainly range from 50 to 150 feet in length.

Typically, the surface layer is very dark brown loam about 2 inches thick. The subsurface layer is brown silt loam about 4 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam; below this is strong brown and dark yellowish brown, firm clay loam and sandy clay loam; and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown sandy loam. In cultivated areas, the plow layer is brown or grayish brown silt loam or loam. In severely eroded areas, the surface layer is yellowish brown silt loam or loam. In Cass and Washington Townships, the lower part of the subsoil and the substratum formed in residuum from sandstone and shale, and fractured sandstone and shale bedrock is below a depth of 5 to 10 feet.

Included with this soil in mapping are narrow, elongated areas of well drained, gently sloping Pike soils that are underlain by glacial till. Moderately well drained Ava soils are on top of ridges between draws. Narrow, elongated areas of somewhat poorly drained Newark and Stendal soils are along drainageways in the bottom of draws. Also included are small areas of soil that have more slope or less slope than this Hickory soil. The included soils make up about 20 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is rapid or very rapid. The surface layer is friable and easy to work.

Most areas of this soil are used for woodland. Some areas are used for growing grasses for pasture. A few narrow bands of this soil in fields of less sloping soils are used for corn, soybeans, or small grain.

This Hickory soil is generally not suited to corn or soybeans because of slope and the hazard of erosion. The moderately steep slopes hinder the use of farm machinery. Small grain is grown occasionally when pasture is being reseeded.

Grasses and legumes grown for pasture are suited to this soil (fig. 9). The moderately steep slopes hinder the use of hay harvesting machinery. Pasture and hayland effectively prevent excessive runoff and subsequent erosion. Overgrazing and grazing when the soil is wet cause surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely grazing keep the pasture and soil in good condition.

This soil is suited to trees, and in places areas have been reforested by natural seeding or by planting trees. The hazard of erosion, equipment limitations, and plant competition are the main management concerns. Proper management of ground cover, placing logging roads on

Figure 9.—Hayland on nearly level Steff soils in the foreground and pasture on Hickory soils that have slopes of 20 to 30 percent in the background.

the contour, and timely use of equipment when the topsoil is dry and firm help reduce soil erosion. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites and septic tank absorption fields because of moderately steep slopes. Designing buildings to complement the slope helps overcome this limitation. Landshaping and installing retaining walls are required in places. Disturbed areas should be revegetated during or soon after construction. Landshaping and installing distribution lines of septic tanks across the slope generally are necessary for proper functioning of the absorption field. Slope and low strength are severe limitations for local roads and streets. Constructing local roads and streets on the contour and shaping of land help overcome the slope limitation. The base material for roads needs strengthening or replacing with a more suitable material to support vehicular traffic.

This soil is in capability subclass VIe and woodland suitability subclass 1r.

HcF—Hickory loam, 30 to 70 percent slopes. This soil is steep and very steep, deep, and well drained. It is on uplands on concave breaks in draws and on narrow breaks to bottom lands. This soil formed mainly in glacial till. Most slopes range from 50 to 150 feet in length. Areas are narrow, elongated, and range from 10 to 100 acres.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is pale brown loam about 5 inches thick. The subsoil is about 21 inches thick. The upper part is yellowish brown friable loam; below this is yellowish brown, firm clay loam; and the lower part is dark yellowish brown, friable clay loam. The substratum to a depth of about 60 inches is brown loam. A few areas that have been used for pasture are eroded, and the surface layer is mostly brown loam. The

substratum is within a depth of 18 inches in a few areas that have slopes of more than 50 percent. In small areas in Cass and Washington Townships, the lower part of the subsoil and the substratum formed in residuum derived from sandstone and shale bedrock. In places, the upper part of slopes formed in loamy outwash.

Included with this soil in mapping are narrow, elongated areas of gently sloping, moderately well drained Ava soils on top of ridges between draws and narrow, elongated areas of somewhat poorly drained Shoals and Stendal soils along drainageways in the bottom of draws. Sandstone bedrock is exposed in the bottom of some deep draws in Cass and Washington Townships. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is very rapid. The surface layer is friable and easy to work.

Nearly all areas of this soil are used for woodland. Small parts of a few areas are in pasture.

This Hickory soil is not suited to corn, soybeans, or small grain because of the hazard of excessive runoff and subsequent erosion. The steep and very steep slopes severely hinder the use of tillage machinery.

Grasses and legumes grown for hay and pasture are generally not suited to this soil. The steep and very steep slopes severely hinder the use of harvesting machinery. Grazing in wooded areas that are included in pastureland should be restricted to prevent exposure of the soil and subsequent erosion.

This soil is suited to trees. The use of this soil for woodland helps control erosion. The hazard of erosion, equipment limitations, and plant competition are concerns. Proper management of ground cover helps reduce erosion. Most logging machinery cannot operate on the steep and very steep slopes. Logging roads can be located on ridgetops. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of slope. The slope is also a severe limitation for local roads. Cutting and filling are needed, and roads should be built on the contour where possible. Providing adequate side ditches and culverts help prevent excessive erosion. Disturbed areas should be revegetated during or soon after construction.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

Ho—Hoosierville silt loam. This soil is nearly level, deep, and poorly drained. It is on broad flats between draws on uplands. Areas are mainly broad, irregular in shape, and range from 40 to 600 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is grayish brown, mottled silt loam about 4 inches thick. The subsoil is about 47 inches thick. The upper part is light brownish gray, mottled, firm silt loam; below this is gray, mottled, firm silty clay loam; and the lower part is yellowish brown, mottled, firm silt loam. The substratum to a depth of about 70 inches is yellowish brown, mottled silt loam. The surface layer is dark gray in a few small depressions or swales on flats and at the head of drainageways.

Included with this soil in mapping are small areas of somewhat poorly drained Iva soils on low rises. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is moderately slow. The organic matter content is moderate, and surface runoff is slow. The seasonal high water table is commonly at or near the surface in winter and early in spring. The surface layer is friable and easy to work through a fairly wide range of soil moisture but tends to crust or puddle after heavy rains.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture or are in woodland.

This Hoosierville soil is suited to corn, soybeans, and small grain. Wetness is a serious limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Subsurface drainage is common. Drainage ditches are needed in some areas to provide drainage outlets. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface, cover crops, and green manure crops help maintain organic matter content and provide good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes should depend on completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is poorly suited to trees. Some undrained areas are used for woodland. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are concerns in management. Harvesting is generally delayed until dry seasons or until the ground is frozen. Species that tolerate wet conditions are favored in timber stands. Some replanting of seedlings is needed in places. Seedlings survive and grow well when competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Wetness, low strength, and frost action are severe limitations for local roads and streets. Providing adequate drainage along roads and replacing

and strengthening the base materials with a more suitable material to support vehicular traffic help overcome these limitations. Moderately slow permeability and wetness are severe limitations for septic tank absorption fields. Excavating the slowly permeable material and replacing it with more permeable material reduces the effects of moderately slow permeability. Installing subsurface drains around the outer edges of the absorption field helps remove the excess wetness.

This soil is in capability subclass IIIw and woodland suitability subclass 3w.

IvA—Iva silt loam, 0 to 2 percent slopes. This soil is nearly level, deep, and somewhat poorly drained. It is on broad flats and nearly level divides between draws on uplands. Areas are irregular in shape and range from 20 to 300 acres.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 3 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, mottled, friable silt loam; below this is light brownish gray, mottled, firm silty clay loam; and the lower part is light brownish gray, mottled, friable silt loam. The substratum to a depth of 60 inches is light brownish gray, mottled silt loam. The surface layer is dark gray in a few small slightly depressional swales on flats and at the head of drainageways. Small areas of poorly drained soils that are similar to this Iva soil are on broad flats and in swales at the head of drainageways. A few areas in the northwestern corner of Dick Johnson Township are slightly acid or neutral in the upper part of the subsoil and mildly alkaline or moderately alkaline in the lower part. In a few places, slopes are more than 2 percent.

Included with this soil in mapping are a few areas of moderately well drained Ava soils on low rises and narrow strips along small drainageways. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is slow. The organic matter content is moderately low, and surface runoff is slow. Potential frost action or heaving is high. The surface layer is friable and easy to work when moist but tends to puddle and crust over after hard rains. The seasonal high water table is at a depth of 1 foot to 3 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture or are in woodland.

This Iva soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Subsurface drainage is common. Drainage ditches are needed in a few areas to provide tile outlets. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth. Erosion is an additional problem on the included soils that have slopes of 3 percent. Shallow gullies can result when concentrated runoff from nearly level, higher areas flows across gently sloping areas of this soil.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes should depend on completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Grazing when the soil is too wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Low strength and frost action are severe limitations for local roads and streets. Providing adequate drainage along roads and replacing and strengthening the base material with a more suitable material to support vehicular traffic help overcome these limitations. Slow permeability and wetness are severe limitations for septic tank absorption fields. The slow permeability can be reduced by excavating the slowly permeable material and replacing it with more permeable material. Installing subsurface drains around the outer edges of the absorption field helps to remove the excess wetness.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

Lo—Lobdell loam, occasionally flooded. This soil is nearly level, deep, and moderately well drained. It is on bottom lands. Areas range from 15 to 100 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part of the subsoil is dark grayish brown and brown, friable loam, and the lower part is brown, mottled, friable loam. The upper part of the substratum is brown, mottled silt loam and loam, and the lower part is grayish brown, mottled, stratified sandy loam, silt loam, loam, and sand to a depth of 60 inches. The substratum below a depth of 36 inches is sand in places.

Included with this soil in mapping are somewhat poorly drained Shoals soils in small swales and in irregularly shaped areas. A few narrow, elongated strips of well drained Stonelick soils are near stream channels where sandbars have developed. The included soils make up about 12 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface

layer is moderate, and surface runoff is slow. The surface layer is friable and easy to till through a wide range of soil moisture. The seasonal high water table is at a depth of 2 to 3.5 feet during winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for small grain or grasses and legumes for hay or pasture. Many narrow bottom lands and the adjacent steep sides of draws are used for pasture or are in woodland.

This Lobdell soil is well suited to corn, soybeans, and grain sorghum. Occasional flooding is a hazard, and in some years crops must be replanted because flooding has destroyed stands. Flooding is more of a hazard in winter and spring than at other times during the year, and small grain and alfalfa are subject to damage. Dikes and levees help to prevent damage from flooding in wide bottoms; however, dikes and levees commonly are not suited in narrow bottoms. Conservation tillage that leaves protective crop residue on the surface, green manure crops, and cover crops help improve organic matter content and maintain good tilth. In places random subsurface drains are needed in seeps at the edge of bottoms, and in the included Shoals soils in small swales. A permanent cover of grasses, shrubs, and trees helps prevent scour damage on streambanks.

Grasses and legumes grown for hay and pasture are well suited to this soil. Alfalfa is occasionally damaged by flooding. Proper stocking rates, pasture rotation, restricted use during wet periods, and timely grazing help keep the pasture and soil in good condition. Scour damage commonly results when livestock destroy the vegetative cover on streambanks.

This soil is well suited to trees. The narrow bottoms in some areas and the adjacent steep or very steep soils are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because it is subject to occasional flooding. Flooding and frost action are severe limitations for local roads. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

Ly—Lyles fine sandy loam. This soil is nearly level, deep, and very poorly drained. It is in swales or depressions on uplands. It is frequently ponded with surface runoff from adjacent, higher lying soils. Areas are irregular in shape and range from 3 to 40 acres.

Typically, the surface layer is very dark gray, fine sandy loam about 8 inches thick. The subsurface layer is very dark gray fine sandy loam about 9 inches thick. The subsoil is about 43 inches thick. The upper part is dark gray, mottled, friable fine sandy loam; below this is gray, mottled, friable fine sandy loam with thin strata of sandy clay loam; and the lower part is light brownish gray, mottled, very friable, stratified loamy fine sand and sandy loam. The substratum to a depth of about 70 inches is light brownish gray, mottled fine sand. In areas, the surface layer is 18 to 24 inches thick. In a few areas, the surface layer is loam, and the upper part of the subsoil mainly is clay loam or silty clay loam.

Included with this soil in mapping are small, slightly higher areas of somewhat poorly drained Ayrshire soils. The included soils make up about 8 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is high, and surface runoff is slow to ponded. The surface layer is friable and easy to work through a wide range of soil moisture. The seasonal high water table is at or above the surface during winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture or are in woodland.

This Lyles soil is well suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Land smoothing and shallow surface drains help remove excess surface water. Seepage from adjacent higher lying areas causes excessively wet spots in some places. Outlets for subsurface drains are difficult to find in places. Special blinding material is needed to prevent sand from filling subsurface drains. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil. The selection of legumes should depend on completeness of drainage. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Overgrazing and grazing when the soil is wet cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, restricted use during wet periods, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations and planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of ponding. Ponding, frost action, and low strength of the

soil are severe limitations for local roads. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material helps overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from ponding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Mt—Montgomery Variant silty clay loam. This soil is nearly level, deep, and very poorly drained. It is on broad, flat lake plains or low terraces. It is frequently ponded with surface runoff from adjacent, higher lying soils. Areas are irregular in shape and range from 100 to 300 acres.

Typically, the surface layer is very dark gray silty clay loam about 7 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is gray, mottled, firm and very firm silty clay loam to a depth of 80 inches. Some areas adjacent to Alvin or Princeton soils have sandy loam, sand, or sandy clay loam below a depth of 55 inches. The A horizon is 15 to 24 inches thick in places.

Included with this soil in mapping are small spots of very poorly drained Lyles soils that contain more sand than Montgomery Variant soil. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is slow or very slow. Organic matter content of the surface layer is high, and surface runoff is very slow to ponded. The surface layer becomes cloddy and difficult to work if plowed when too wet or too dry. It is sticky when wet. The seasonal high water table is at or above the surface during winter and early in spring.

Most areas of this soil are used for cultivated crops.

This Montgomery Variant soil is suited to corn, soybeans, and small grain. Wetness is a serious limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Drainage outlets are difficult to find in places. The limited permeability of the soil restricts the effectiveness of subsurface drains, and narrow spacings are needed. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface, green manure crops, and cover crops help improve tilth and maintain organic matter content. Small grain is subject to damage from ponding in winter and early in spring.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes is restricted by seasonal wetness. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Overgrazing and grazing when the soil is too wet damage the sod, reduce plant density, reduce forage yields, and cause surface compaction and poor tilth. Proper stocking rates, timely grazing, and restricted use during wet periods reduce surface compaction and keep the pasture and soil in good condition.

This soil is suited to trees but is seldom used for wood crops. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations and the planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of ponding. Ponding and low strength of the soil are severe limitations for local roads. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material helps overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from ponding.

This soil is in capability subclass IIIw and woodland suitablity subclass 2w.

MuA—Muren silt loam, 0 to 2 percent slopes. This soil is nearly level, deep, and moderately well drained. It is on uplands on ridgetops adjacent to draws and on flat-topped knolls. Most areas are narrow and elongated and average 2 to 10 acres.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsurface layer is yellowish brown silt loam about 3 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam; below this is yellowish brown, mottled, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of about 72 inches is yellowish brown, mottled loam. In places adjacent to draws, the subsoil is not mottled.

Included with this soil in mapping are a few small areas of somewhat poorly drained Iva soils in shallow drainageways and on small flats. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is moderately slow. The organic matter content is moderate, and surface runoff is slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is at a depth of 3 to 6 feet during spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few areas are in woodland.

This Muren soil is well suited to corn, soybeans, and small grain. It has no serious hazards or limitations to use and management. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve

organic matter content and maintain good tilth. Subsurface drains are needed in the included areas of Iva silt loam on flats and in drainageways.

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. In some areas, the narrow ridgetops between draws are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of shrinking and swelling of the soil. Wetness is an additional limitation for dwellings with basements. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps prevent structural damage caused by shrinking and swelling. Installing drains around footings helps lower the water table for basements.

Low strength, frost action, and wetness are severe limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help overcome the low strength and frost action. Providing adequate side ditches and culverts reduces wetness.

Wetness and moderately slow permeability are severe limitations for septic tank absorption fields. These limitations can be reduced by excavating the slowly permeable material, replacing it with more permeable material, and installing subsurface drains around the outer edges of the absorption field.

This soil is in capability class I and woodland suitability subclass 1o.

MuB2—Muren silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping, deep, and moderately well drained. It is on uplands on ridgetops or knolls and on breaks along drainageways. Areas range from 5 to 40 acres. Most slopes are 100 to 300 feet long.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 45 inches thick. The upper part is yellowish brown, friable silt loam; below this is yellowish brown, mottled, firm silty clay loam; and the lower part is yellowish brown, mottled, friable silt loam. The substratum to a depth of 60 inches is yellowish brown, mottled silt loam. Areas in woods are not eroded, and the original surface soil remains. Small, nearly level areas on tops of ridges and knolls are only slightly eroded. In places, the subsoil is not mottled.

Included with this soil in mapping are small areas of somewhat poorly drained Iva silt loam along narrow drainageways and on small flats. A few areas on breaks along drainageways and side slopes along ridges have a weak fragipan at a depth of 30 to 40 inches. Small areas have slopes of less than 2 percent or more than 6 percent. The included soils make up about 12 percent of mapped areas.

Available water capacity is high, and permeability is moderately slow. The organic matter content is moderate, and surface runoff is rapid. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is at a depth of 3 to 6 feet during spring.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for woodland.

This Muren soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crop rotations and contour farming help control erosion. Where slopes are long, terraces are suitable for erosion control. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help prevent erosion, improve organic matter content, and maintain good tilth. Subsurface drains are needed in the included areas of Iva soils on small flats and in narrow drainageways.

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees. Some areas on narrow ridgetops between draws are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of shrinking and swelling of the soil. Wetness is an additional limitation for dwellings with basements. Foundations, footings, and basement walls should be strengthened. Backfilling with coarser material helps prevent structural damage caused by shrinking and swelling. Installing drains around footings helps lower the water table for basements.

Low strength, frost action, and wetness are severe limitations for local roads and streets. Replacing the layers of soil that have moderate shrink-swell potential with suitable soil material and covering the soil surface with suitable base material help overcome the low strength and frost action. Providing adequate side ditches and culverts reduces the wetness.

Wetness and moderately slow permeability are severe limitations for septic tank absorption fields. These limitations can be reduced by excavating the slowly permeable material, replacing it with more permeable material, and installing subsurface drains around the outer edges of the absorption field.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

Ne—Newark silt loam, frequently flooded. This soil is nearly level, deep, and somewhat poorly drained. It is on bottom lands. Areas along small streams are narrow, elongated, and range from 5 to 40 acres. Areas along the Eel River are irregular in shape and range from 50 to 300 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is pale brown, mottled, friable silt loam, and the lower part is grayish brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is light brownish gray, mottled silt loam. In places in the Eel River bottoms, the lower part of the substratum is silty clay loam. The upper part of the profile is loam in some areas and sandy loam and loamy fine sand below a depth of 30 inches in other areas.

Included with this soil in mapping are a few small areas of moderately well drained Wilbur soils adjacent to stream channels. The included soils make up about 6 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is very slow. The surface layer is friable and easy to work. The seasonal high water table commonly is at a depth of 1/2 foot to 1 1/2 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. Some narrow areas along streams are used for pasture, and some are in woodland.

This Newark soil is suited to corn, soybeans, and grain sorghum. Most areas have been drained so that crops can be grown. Flooding is a hazard, and in some years crops must be replanted because flooding has destroyed stands. Dikes and levees are generally not used along small streams to prevent flooding because most bottoms are narrow; however, dikes and levees are useful in the Eel River bottoms. Wetness is a limitation for this soil, and drainage is needed. Subsurface drains are common, and land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. Deep-rooted legumes, such as alfalfa, are not well suited because of wetness, frost heaving, and damage from flooding. Overgrazing and trampling by livestock when the soil is wet cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition. Scour damage commonly results when livestock destroy the vegetative cover on streambanks. A permanent cover of grasses, shrubs, and trees help prevent scour damage on streambanks.

This soil is well suited to trees. In many areas, the narrow bottoms adjacent to steep or very steep soils are used for woodland. Plant competition is the main management concern. Plants survive and grow well if competing vegetation is controlled by cutting, spraying or girdling.

This soil is severely limited and generally is not suitable for building sites and sanitary facilities because it is subject to flooding. Flooding, frost action, and low strength of the soil are severe limitations for local roads. Replacing the layers of the soil that have low strength with suitable soil material helps overcome the low strength. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

No—Nolin silt loam, rarely flooded. This soil is nearly level, deep, and well drained. It is on broad bottom lands. This soil is at a slightly higher elevation than the adjacent bottom land soils. Areas are irregular in shape and range from 30 to 200 acres.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, friable silt loam about 31 inches thick. The upper part of the substratum is yellowish brown, stratified loam and silt loam, and the lower part to a depth of about 60 inches is yellowish brown, stratified loam, fine sandy loam, and loamy fine sand. In a few swales and on adjacent flats, this soil is mottled below a depth of 30 inches. A few small areas adjacent to swales contain strata of fine sandy loam and loamy fine sand.

Included with this soil in mapping are a few narrow, elongated areas of somewhat poorly drained Newark soils in swales and drainageways. The included soils make up about 6 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate, and surface runoff is slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table is at a depth of 3 to 6 feet.

Most areas of this soil are used for cultivated crops.

This Nolin soil is well suited to corn, soybeans, and grain sorghum. Wheat is occasionally damaged by flooding in winter and spring. In some years, crops need to be replanted because rare flooding has destroyed stands. Dikes and levees help prevent flooding. Subsurface drains are needed in small swales. Conservation tillage that leaves protective crop residue on the surface and winter cover crops help maintain organic matter content and improve tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil, but the soil is seldom used for that purpose. Alfalfa is occasionally damaged by flooding in winter and spring. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees, but it is seldom used for wood crops. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilties because it is subject to rare flooding. Low strength and frost action are severe limitations for local roads and streets. Providing adequate side ditches and culverts along roads and replacing or strengthening the base material with more suitable material to support vehicular traffic help reduce the limitations.

This soil is in capability class I and woodland suitability subclass 3o.

Nr—Nolin, silty clay loam, rarely flooded. This soil is nearly level, deep, and well drained. It is on broad, flat bottom lands. It is somewhat higher in elevation than adjacent bottom land soils. Areas are irregular in shape and range from 40 to 250 acres.

Typically, the surface layer is dark brown silty clay loam about 7 inches thick. The subsurface layer is dark brown silty clay loam about 5 inches thick. The subsoil is about 38 inches thick. The upper part is dark brown, firm silty clay loam; the next part is brown, firm silty clay loam; and the lower part is dark yellowish brown, friable silty clay loam. The substratum to a depth of about 60 inches is yellowish brown, stratified loam, silt loam, and fine sandy loam. A few small areas along drainageways are silt loam throughout.

Included with this soil in mapping are a few narrow, elongated areas of poorly drained Petrolia soils in small swales. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate, and surface runoff is slow. The surface layer is friable and easy to work when the soil is moist. If this soil is worked when wet, it is somewhat sticky and becomes hard and cloddy when dry. The seasonal high water table is at a depth of 3 to 6 feet.

Nearly all areas of this soil are used for cultivated crops.

This Nolin soil is well suited to corn, soybeans, and grain sorghum. Wheat is damaged by rare flooding in winter and early in spring. In some years, crops need to be replanted because flooding has destroyed stands. Dikes and levees help prevent flooding. Subsurface drains are needed in small swales. Conservation tillage that leaves protective crop residue on the surface and winter cover crops help maintain organic matter content and improve tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil, but the soil is seldom used for this purpose. Alfalfa is damaged by rare flooding in winter and spring. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees, but it is seldom used for wood crops. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because it is subject to rare flooding. Low strength and frost action are severe limitations for local roads and streets. Providing adequate side ditches and culverts along roads and replacing or strengthening the base material with more suitable material to support vehicular traffic help reduce the limitations.

This soil is in capability class I and woodland suitability subclass 3o.

PaD2—Parke silt loam, 12 to 18 percent slopes, eroded. This soil is strongly sloping, deep, and well drained. It is on side slopes of ridges and knolls and along drainageways on uplands. Most areas are narrow and elongated and range from 3 to 20 acres. Slopes are mainly 50 to 150 feet long.

Typically, the surface layer is brown silt loam about 6 inches thick. The upper part of the subsoil is brown, firm silty clay loam; below this is strong brown, firm and friable silt loam and brown, friable loam; and the lower part is reddish brown, firm sandy clay loam and friable sandy loam to a depth of 80 inches. In places, loamy sand with bands of sand is below a depth of 80 inches. In small areas, the subsoil has more silt and less sand than the typical profile.

Included with this soil in mapping are small areas of well drained Bloomfield soils on side slopes of knolls and a few areas of moderately steep, well drained Chetwynd soils in draws and on breaks to bottom lands. Both of these soils contain more sand than the Parke soil. Also included are small areas of soils that have less than 12 percent slopes or more than 18 percent slopes. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderately low, and surface runoff is very rapid. The surface layer is friable and easy to work.

Many areas of this soil are used for cultivated crops or hay and pasture. Some areas are used for woodland.

This Parke soil is poorly suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crop rotations and contour farming help prevent erosion.

Conservation tillage that leaves protective crop residue on the surface helps prevent erosion, improve organic matter content, and maintain good tilth. Grassed waterways are commonly used to prevent gullying in the bottom of draws.

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Hay and pasture helps control erosion. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of slope. Buildings should be designed and located to complement the slope. Land shaping and installing retaining walls help overcome this limitation. Disturbed areas should be revegetated during or soon after construction to keep erosion at a minimum. Slope, low strength, and frost action are severe limitations for local roads and streets. Constructing local roads on the contour and land shaping help overcome the slope limitation. Replacing the moderate shrink-swell layers with suitable soil material and covering the soil surface with suitable base material help overcome the effects of low strength and frost action. Slope is a severe limitation for septic tank absorption fields. Installing the absorption field on the contour helps to overcome this limitation.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

Pf—Peoga silt loam. This soil is nearly level, deep, and poorly drained. It is on broad, flat, glacial lake plains and slack water terraces. Areas are irregular in shape and range from 300 to 1,000 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is grayish brown, mottled silt loam about 3 inches thick. The subsoil is gray, mottled, firm silty clay loam to a depth of 60 inches. The substratum to a depth of 70 inches is mottled, gray and strong brown, stratified silty clay loam and silt loam. The substratum is clay loam in some areas that are adjacent to the upland.

Included with this soil in mapping are narrow, elongated areas of somewhat poorly drained Henshaw soils on breaks to bottom lands and along drainageways. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is slow. Organic matter content of the surface layer is moderate, and surface runoff is slow or very slow. The surface layer is friable and easy to work but tends to puddle and crust after heavy rains. The seasonal high water table is at or near the surface in winter and spring.

Most areas of this soil are used for cultivated crops. A few areas are used for hay and pasture or are in woodland.

This Peoga soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Subsurface drains help overcome the wetness, but drainage outlets are difficult to find in places. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content of the surface layer and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes should depend on completeness of drainage. Deep-rooted crops, such as alfalfa, are poorly suited because of wetness and frost heaving. Overgrazing or grazing when the soil is too wet damages the sod, reduces plant densities, reduces forage yields, and causes surface compaction and poor tilth. Proper stocking rates, timely grazing, and restricted use during wet periods reduce surface compaction and keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations and the planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Wetness, low strength, and frost action are severe limitations for local roads and streets. Providing adequate drainage along roads and replacing and strengthening the base material with more suitable material to support vehicular traffic help overcome these limitations. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations can be reduced by excavating the slowly permeable material, replacing it with more permeable material, and installing subsurface drains around the outer edges of the absorption field.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Pg—Petrolia silty clay loam, frequently flooded. This soil is nearly level, deep, and poorly drained. It is on flats and in swales on broad bottom lands. Areas are generally elongated and range from 20 to 100 acres.

Typically, the surface layer is dark grayish brown silty clay loam about 7 inches thick. The subsoil is gray,

mottled, firm silty clay loam about 48 inches thick. The substratum to a depth of 60 inches is gray, mottled, stratified silt loam and silty clay loam. Silty clay or clay loam is below a depth of 40 inches in some areas. In places, the soil is dark grayish brown silt loam to a depth of 8 to 15 inches. In small areas, the surface layer and subsoil are silty clay.

Included with this soil in mapping are small areas of somewhat poorly drained Newark soils adjacent to drainageways on bottom lands. The included soils make up about 7 percent of mapped areas.

Available water capacity is high, and permeability is moderately slow. The water table commonly is at the surface or ranges to a depth of 3 feet in winter and early in spring. Organic matter content of the surface layer is moderate, and surface runoff is very slow or ponded. If the surface layer is worked when it is wet and sticky, it becomes cloddy when dry.

Nearly all areas of this soil are used for cultivated crops.

This Petrolia soil is well suited to corn, soybeans, and small grain. Most areas have been drained so that crops can be grown; however, additional drainage is needed in many areas. Drainage outlets are difficult to find in some back bottom lands. Conservation tillage that leaves protective crop residue on the surface and winter cover crops help improve organic matter content and maintain good tilth. Levees protect crops from flooding during the growing season.

Grasses and legumes grown for hay and pasture are well suited to this soil, but the soil is seldom used for pasture and hayland. Deep-rooted legumes, such as alfalfa, are poorly suited because of frost heaving and the seasonal high water table. Some kinds of grasses and legumes can be grown without drainage, but drainage is generally beneficial. Grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted grazing during wet seasons help keep the pasture and soil in good condition. Scour damage commonly results when livestock destroy the vegetative cover on streambanks.

This soil is suited to trees, but it is seldom used for wood crops. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Seasonal wetness can cause delay in planting and harvesting operations. Harvesting is generally delayed until dry seasons or until the ground is frozen. Wetness restricts root growth. Species that can tolerate wet conditions are favored in timber stands. Seedlings survive and grow fairly well when competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally is not suitable for building sites and sanitary facilities because it is subject to flooding. Flooding, frost action, and low strength of the soil are severe limitations for local roads. Replacing the layers of the soil that have moderate shrink-swell potential with suitable soil material helps overcome the low strength limitation. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

PkA—Pike silt loam, 0 to 2 percent slopes. This soil is nearly level, deep, and well drained. It is on uplands on flat-topped ridges and knolls. Areas are irregular in shape and range from 5 to 100 acres.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsurface layer is yellowish brown silt loam about 2 inches thick. The upper part of the subsoil is strong brown, firm and friable silty clay loam; below this is brown, friable loam; and the lower part is reddish brown, friable sandy clay loam to a depth of 80 inches. The depth to the reddish brown sandy clay loam outwash is as much as 7 1/2 feet in places. Narrow areas of gently sloping soils are along drainageways. In places, the loess is less than 40 inches thick.

Included with this soil in mapping are a few small areas of moderately well drained Muren soils in slight depressions. The included soils make up about 5 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture.

Most areas of this soil are used for cultivated crops. A few small areas are used for hay or pasture or are in woodland.

This Pike soil is well suited to corn, soybeans, and small grain. It has no serious hazards or limitations. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted grazing during wet seasons help keep the pasture and soil in good condition.

This soil is well suited to trees. A few areas on narrow ridgetops between very steep draws are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable for building sites and septic tank absorption fields. Frost action and low strength are severe limitations for local roads and streets. Replacing or strengthening the base material with more suitable material to support vehicular traffic and providing adequate side ditches and culverts along the roads to

eliminate excessive wetness help reduce these limitations.

This soil is in capability class I and woodland suitability subclass 1o.

PkB2—Pike silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping, deep, and well drained. It is on uplands on ridgetops or knolls and on breaks along drainageways. Most areas on narrow ridgetops and along drainageways are elongated and about 2 to 5 acres. Areas on knolls are irregular in shape and range from 5 to 60 acres. Slopes are generally 100 to 300 feet long.

Typically, the surface layer is dark yellowish brown silt loam about 9 inches thick. The upper part of the subsoil is brown, firm silty clay loam; below that is brown, friable silt loam and loam; and the lower part to a depth of 80 inches is yellowish red, firm sandy clay loam. The depth to sandy clay loam outwash is as much as 7 feet in places. Small, nearly level areas are on ridgetops. In places along drainageways, slopes are more than 6 percent. In areas in Cass and Washington Townships, yellowish red outwash is below a depth of 60 inches.

Included with this soil in mapping in similar landscape positions are a few small areas of moderately well drained Ava soils that have a fragipan. The included soils make up about 3 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is rapid. The surface layer is friable and easy to work under a fairly wide range of soil moisture.

Most areas of this soil are used for cultivated crops. A few small areas are used for hay or pasture or are in woodland.

This Pike soil is well suited to corn, soybeans, and small grain. Erosion and runoff are hazards on cropland. Crop rotations and contour farming help prevent erosion. Terraces are suitable for the control of runoff and erosion on long uniform slopes. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help prevent erosion, improve organic matter content, and maintain good soil tilth. Grassed waterways help to prevent gullying in draws.

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. In places, the narrow ridgetops between very steep draws are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable for building sites and septic tank absorption fields. Frost action and low strength are severe limitations for local roads and streets. Replacing or strengthening the base material with more suitable material to support vehicular traffic and providing adequate side ditches and culverts along the roads to eliminate excessive wetness help overcome these limitations.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PkC2—Pike silt loam, 6 to 12 percent slopes, eroded. This soil is moderately sloping, deep, and well drained. It is on side slopes of ridges and knolls and along drainageways on uplands. Most areas are narrow, elongated, and about 3 to 20 acres. Slopes are mainly 75 to 200 feet long.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is about 60 inches thick. The upper part is yellowish brown, firm silty clay loam; below this is brown, friable silt loam and loam; and the lower part is yellowish red, friable sandy clay loam. The substratum to a depth of about 80 inches is yellowish red sandy loam. The surface soil in areas that are not eroded is brown silt loam. Parts of areas in woods are not eroded, and the original surface soil remains. Small, gently sloping areas are on ridgetops and knolls. Small areas on side slopes, in places, contain more sand and less silt in the subsoil than this Pike soil.

Included with this soil in mapping are a few small areas of well drained Cincinnati soils. These Cincinnati soils have a fragipan. They are in a position on the landscape similar to the Pike soils. The included soils make up about 3 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is rapid. The surface layer is friable and easy to work when moist, but it is somewhat sticky when wet and becomes cloddy when dry.

Most areas of this soil are used for cultivated crops. Some areas are used for hay or pasture. A few areas are in woodland.

This Pike soil is fairly well suited to corn, soybeans, and small grain. Erosion and runoff are hazards. Crop rotations and contour farming help prevent erosion. Conservation tillage that leaves protective crop residue on the surface helps prevent erosion, improve organic matter content, and maintain good tilth. Terraces are suited in areas that have long, uniform slopes. Grassed waterways prevent gullying in the bottom of draws (fig. 10).

Grasses and legumes grown for hay and pasture are well suited to this soil. A wide variety of grasses and legumes, including alfalfa, are suited. Hay and pasture effectively prevent erosion. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow

Figure 10.—A grassed waterway in an area of Pike silt loam. The rock chute helps to stabilize the grade and prevent gullying where the waterway empties into a drainage ditch.

well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of slope. Buildings need to be designed to complement the slope. Shaping of the land and installing retaining walls help overcome the slope limitation. Disturbed areas should be revegetated during or soon after construction. Low strength and frost action are severe limitations for local roads and streets. Replacing the layers of this soil that have low strength with suitable soil material and covering the soil surface with suitable base material help overcome the low strength and frost action limitations. Slope is a moderate limitation for septic tank absorption fields. Land shaping and installing distribution lines across the slope generally are necessary for proper functioning of the absorption field.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

PnB—Princeton fine sandy loam, 2 to 6 percent slopes. This soil is gently sloping, deep, and well drained. It is on knolls on uplands. Areas are irregular in shape and range from 3 to 50 acres. Slopes are mainly 50 to 150 feet long.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is dark yellowish brown and brown, friable loam; below this is dark brown, friable sandy loam; and the lower part is dark brown, very friable, loamy sand and sandy loam with bands. The substratum to a depth of about 70 inches is yellowish brown sand. A few, nearly level areas are on ridgetops. In small areas the surface layer and subsoil have more sand than the typical profile.

Included with this soil in mapping are narrow areas of somewhat poorly drained Ayrshire soils in small swales, small areas of droughty, well drained Bloomfield soils on the higher knolls, and areas of soils that have slopes of slightly less than 2 percent or more than 6 percent. The included soils make up about 5 percent of mapped areas.

Available water capacity is high. Permeability is moderate in the solum and moderately rapid in the

underlying material. The organic matter content of the surface layer is moderately low, and surface runoff is medium. The surface layer is friable and easy to work through a wide range of soil moisture.

Most areas of this soil are used for cultivated crops. Some areas are used for pasture or hayland, and a few areas remain in woodland.

This Princeton soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control runoff and erosion. Crop rotations and contour farming help prevent excessive soil loss. Terraces can be used for erosion control in a few areas that have long, even slopes. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops help control erosion and maintain organic matter content. Subsurface drains are needed in many small swales in the included areas of Ayrshire soils. Grassed waterways are needed to prevent gullying in draws.

Grasses and legumes grown for hay and pasture help control erosion. Alfalfa grows well on this soil. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable for dwellings and septic tank absorption fields. Frost action is a moderate limitation for local roads and streets. Providing roadside ditches and culverts help drain surface water and reduce the frost action limitation.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PnC—Princeton fine sandy loam, 6 to 12 percent slopes. This soil is moderately sloping, deep, and well drained. It is on knolls on uplands. Areas are irregular in shape and range from 2 to 25 acres.

Typically, the surface layer is brown fine sandy loam about 9 inches thick. The subsoil is about 47 inches thick. The upper part is dark yellowish brown and brown, friable loam; below this is brown, firm sandy clay loam; and the lower part is brown, friable sandy loam. The substratum to a depth of about 80 inches is light brown fine sand with loamy fine sand and fine sandy loam bands. The surface layer is brown or dark yellowish brown loam in eroded spots. In places, the surface layer and subsoil have more sand than the typical profile. In small areas, this soil is gently sloping or moderately sloping.

Included with this soil in mapping are a few small areas of droughty, well drained Bloomfield soils on knolls. The included soils make up about 5 percent of mapped areas.

Available water capacity is high. Permeability is moderate in the solum and moderately rapid in the underlying material. The organic matter content of the surface layer is moderately low, and surface runoff is medium. The surface layer is friable and easy to work through a wide range of soil moisture.

Most areas of this soil are used for cultivated crops. Some areas are used for pasture or hayland, and a few areas remain in woodland.

This Princeton soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control runoff and erosion. Crop rotations, conservation tillage, and contour farming help prevent excessive soil loss. Terraces help control erosion in a few areas that have long, even slopes. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops help control erosion and maintain organic matter content. Seepage is a concern in draws and at the base of knolls. Subsurface drains are commonly used to intercept seeps at the base of slopes. Grassed waterways or basin terraces are needed to prevent gullying in draws.

Grasses and legumes grown for hay and pasture effectively prevent erosion. Alfalfa grows well on this soil. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is moderately limited for building sites because of slope. Buildings need to be designed to complement the slope. Shaping of land and installing retaining walls help overcome the slope limitation. Disturbed areas should be revegetated during or soon after construction. Slope and frost action are moderate limitations for local roads and streets. Constructing local roads and streets on the contour and land shaping overcome the slope limitation. Providing adequate side ditches and culverts along roads help reduce the frost action. Slope is a moderate limitation for septic tank absorption fields. Land shaping and installing distribution lines across the slope generally are needed for proper functioning of the absorption field.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

Sh—Shoals silt loam, frequently flooded. This soil is nearly level, deep, and somewhat poorly drained. It consists of narrow, elongated bands along small streams in the bottom of draws and broader areas in bottom lands along larger streams. Most areas range from 10 to 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The upper part of the subsoil is brown, mottled, friable silt loam, and the lower part is grayish brown and dark grayish brown, mottled, friable

silt loam and loam. The substratum to a depth of about 60 inches is grayish brown, mottled, stratified loam and sandy loam. In places below a depth of 30 inches, the soil is mostly sand or loamy sand.

Included with this soil in mapping are small areas of a poorly drained soil that is medium textured throughout. Narrow, elongated strips of moderately well drained Lobdell soils are along stream channels. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is very slow. The surface layer is friable and easy to till through a wide range of soil moisture. The seasonal high water table is at a depth of 1 foot to 3 feet during winter and early in spring.

Most areas of this soil are used for cultivated crops. Some areas are used for small grain or for grasses and legumes as hay or pasture. Many narrow areas along small streams are used for pasture or are in woodland.

This Shoals soil is suited to corn, soybeans, and grain sorghum. Flooding is a hazard, and in some years crops need to be replanted because flooding has destroyed stands. Because the hazard of flooding is greater during winter and spring, small grain and alfalfa are subject to severe damage. Dikes and levees are generally not used to control flooding because most bottoms are narrow. Wetness is a limitation, and drainage is needed. Subsurface drains are commonly used, and drainage ditches are needed in some larger bottoms to provide outlets. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth. A permanent cover of grasses, shrubs, and trees helps prevent scour damage on streambanks.

Grasses and legumes grown for hay and pasture are suited to this soil. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Some grasses and legumes can be grown without drainage, but drainage is generally beneficial. Overgrazing and grazing when the soil is wet damage the sod and cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition. Scour damage often results when livestock destroy the vegetative cover on streambanks.

This soil is well suited to trees. Some areas in narrow bottoms adjacent to very steep soils are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of the hazard of flooding and wetness. Flooding and frost action are severe limitations for roads. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts for drainage help protect the roads from flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

Sk—Steff silt loam, occasionally flooded. This soil is nearly level, deep, and moderately well drained. It is in narrow bottom lands along small streams and along swales and drainageways in broad bottom lands. Most areas range from 5 to 60 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil is yellowish brown, mottled, friable silt loam about 21 inches thick. The upper part of the substratum is light brownish gray, mottled silt loam; and the lower part to a depth of about 60 inches is light brownish gray, mottled, stratified silt loam, loam, and fine sandy loam. In places below a depth of 30 inches, the substratum is fine sandy loam and fine sand.

Included with this soil in mapping are narrow, elongated areas of poorly drained Bonnie soils and somewhat poorly drained Stendal soils in small swales and irregularly shaped bottoms adjacent to uplands. A few areas of this soil in narrow bottoms in Cass and Washington Townships have sandstone bedrock below a depth of 30 to 40 inches. The included soils make up about 15 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderate, and surface runoff is slow. The surface layer is friable and easy to work. The seasonal high water table fluctuates between depths of 1 1/2 and 3 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops. A few areas are used for small grains, hayland, and pasture or are in woodland.

This Steff soil is well suited to corn, soybeans, and grain sorghum. Occasional flooding is a hazard, and in some years crops need to be replanted because flooding has destroyed stands. Because the hazard of flooding is greater during winter and early in spring, small grains and alfalfa are subject to damage. Dikes and levees are commonly used to prevent flooding along large streams, but generally are not used along small streams where bottoms are narrow. Conservation tillage that leaves protective crop residue on the surface and the use of green manure crops and cover crops help improve organic matter content and maintain good tilth. A permanent cover of grasses, shrubs, and trees helps prevent scour damage on streambanks.

Grasses and legumes grown for hay and pasture are suited to this soil, but the soil is seldom used for that purpose. Overgrazing and grazing when the soil is wet damage the sod and cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, and some areas in narrow bottoms that are adjacent to very steep soils are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because of occasional flooding and wetness. Flooding, low strength, and frost action are severe limitations for local roads. The base material for roads needs strengthening or needs to be replaced with more suitable material to support vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability class I and woodland suitability subclass 1o.

Sn—Stendal silt loam, frequently flooded. This soil is nearly level, deep, and somewhat poorly drained. It is in narrow bands along small streams and in irregularly shaped areas on broad bottom lands. Most areas range from 10 to 600 acres.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is pale brown, mottled, friable silt loam in the upper part and light brownish gray, mottled, friable silt loam in the lower part. The upper part of the substratum is light brownish gray, mottled silt loam; and the lower part to a depth of 60 inches is light brownish gray, mottled, stratified silt loam, fine sandy loam, loam, and silty clay loam. In areas near streams, the substratum below a depth of 40 inches is mainly fine sand. Small areas have a compact layer or weak fragipan between depths of 24 and 40 inches.

Included with this soil in mapping are small areas of poorly drained and very poorly drained Zipp soils in small swales in broad bottoms. Also, in broad bottoms are small areas of poorly drained and very poorly drained Bonnie soils. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content is moderately low, and surface runoff is very slow. The surface layer is friable and easy to work but tends to puddle and crust after heavy rains. The seasonal high water table fluctuates between a depth of 1 foot and 3 feet during winter and early in spring.

Most areas of this soil are used for cultivated crops. Some areas are used for small grain or grasses and legumes for hay or pasture. Many narrow areas along small streams are used for pasture or are in woodland.

This Stendal soil is suited to corn, soybeans, and grain sorghum. Flooding is a hazard, and in some years crops need to be replanted because flooding has destroyed stands. Dikes and levees prevent flooding along large streams but generally are not practical along small streams where bottoms are narrow. Wetness is a limitation to this soil, and drainage is needed. Subsurface drainage is common. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth.

Grasses and legumes grown for hay and pasture are suited to this soil, but the soil is seldom used for that purpose. Deep-rooted legumes, such as alfalfa, are poorly suited because of wetness and frost heaving. Some kinds of grasses and legumes can be grown without drainage, but drainage is generally beneficial. Overgrazing and grazing when the soil is wet damage the sod and cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition. A permanent cover of grasses, shrubs, and trees helps prevent scour damage to streambanks.

This soil is well suited to trees. Areas in narrow bottoms adjacent to very steep soils are used for woodland. Plant competition is the main management concern. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and is generally not suitable for building sites and sanitary facilities because of the hazard of flooding and wetness. Flooding, low strength, and frost action are severe limitations for local roads. The base material for roads needs strengthening or the material with low strength needs replacing with more suitable material to provide support for vehicular traffic. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

VgA—Vigo silt loam, 0 to 2 percent slopes. This soil is nearly level, deep, and poorly drained. It is on broad flats and ridgetops on uplands and on narrow flats between draws. Areas are irregular in shape and range from 20 to 200 acres.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is light brownish gray, mottled silt loam about 17 inches thick. The upper part of the subsoil is light gray, mottled, firm and very firm silty clay loam, and the lower part to a depth of about 80 inches is yellowish brown, mottled, firm clay loam. A few small areas of poorly drained, finer textured soil, similar to this Vigo soil, are in swales and on flats at the head of drainageways.

Included with this soil in mapping are a few small areas of moderately well drained Ava soils on breaks along drainageways. The Ava soil has a fragipan and has slopes of 2 or 3 percent. Also included are a few

areas of soils that have slightly more slope than this Vigo soil. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is very slow. The organic matter content is moderately low, and surface runoff is slow. The surface layer is friable and easy to work. The seasonal high water table fluctuates between depths of 1/2 foot to 2 1/2 feet.

Most areas of this soil are used for cultivated crops. A few areas are used for hay or pasture or are in woodland.

This Vigo soil is suited to corn, soybeans, and small grains. Wetness is a limitation. Drainage has been established in most areas so that cultivated crops can be grown; however, additional drainage is needed in many areas. Subsurface drains are common. Land smoothing and shallow surface drains help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface and the use of cover crops and green manure crops help improve organic matter content and maintain good tilth. Erosion is a problem on the included soils that have slopes of 2 to 3 percent. Contour farming and terraces help control erosion on these gently sloping soils.

Grasses and legumes grown for hay and pasture are well suited to this soil. The selection of legumes should depend on completeness of drainage. Alfalfa is not well suited because of wetness and frost heaving. Overgrazing and trampling by livestock when the soil is wet damage the sod, reduce plant densities and forage yields, and cause surface compaction and poor tilth.

This soil is suited to trees. Equipment limitations, seedling mortality, windthrow hazard and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations and the planting of seedlings. Water-tolerant species are favored in timber stands. In places, replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites because of wetness. Installing drains around footings helps lower the water table. Wetness, low strength, and frost action are severe limitations for local roads and streets. Providing adequate drainage along roads and replacing and strengthening the base material with more suitable material to support vehicular traffic help overcome these limitations. Septic tank absorption fields are severely limited because of very slow permeability and wetness. The very slow permeability can be overcome by excavating the very slowly permeable material and replacing it with more permeable material. Installing subsurface drains around the outer edges of the absorption field removes excess wetness.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

WeD2—Wellston silt loam, 12 to 18 percent slopes, eroded. This soil is strongly sloping, deep, and well drained. It is on uplands on knolls and narrow breaks along bottom lands and drainageways. Areas are irregular in shape and range from 2 to 30 acres.

Typically, the surface layer is brown silt loam about 3 inches thick. The subsoil is about 48 inches thick. The upper part is dark yellowish brown and yellowish brown, friable silt loam and silty clay loam, and the lower part is yellowish brown, friable channery loam. Below this to a depth of 60 inches is interbedded fractured sandstone and shale bedrock. Areas that have remained in woods are not eroded and have a very dark grayish brown surface layer. In places, the upper part of the profile formed in loamy glacial till.

Included with this soil in mapping are small areas of well drained Cincinnati soils on narrow ridgetops. These soils have a fragipan. A few small areas of well drained Berks soils are on landscape positions similar to those of this Wellston soil. These soils formed in residuum from sandstone and shale and have slopes of 15 to 25 percent. The somewhat poorly drained Stendal soils are in narrow strips along drainageways in draws. A few areas of soils have large, coarse fragments of sandstone in the upper part of the profile and on the surface. The included soils make up about 15 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderately low, and surface runoff is very rapid. This soil is easy to work when moist. If worked when wet, it is somewhat sticky and becomes hard and cloddy when dry.

Most areas of this soil are used for permanent pasture or are in woods. A few areas that are included in fields with less sloping soils are used for cultivated crops.

This Wellston soil is generally not suited to corn or soybeans because of slope and the hazard of erosion. It is moderately well suited to small grains, which are commonly used as nurse crops when reseeding grasses and legumes. Conservation tillage that leaves protective crop residue on the surface and contour farming help control erosion. The large sandstone fragments near the surface in a few included areas restrict the use of tillage implements. Small areas that are included in fields with less sloping soils can be protected from excessive soil loss by keeping them in permanent sod.

Grasses and legumes grown for hay and pasture are well suited to this soil. Permanent hayland or pasture helps control excessive erosion. Overgrazing causes surface compaction and excessive runoff, which often results in erosion. Proper stocking rates, pasture rotation, and timely grazing help keep the pasture and soil in good condition.

This soil is suited to trees. The hazard of erosion, equipment limitations, and plant competition are management concerns. Slope hinders the use of some

logging equipment. Logging roads should be placed on the contour to minimize erosion and to facilitate equipment operations. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited for building sites and septic tank absorption fields because of strong slopes. Buildings need to be designed to complement the slope. Shaping of the land and installation of retaining walls are required in places. Disturbed areas should be revegetated during or soon after construction. Shaping of the land and installing distribution lines across the slope generally are necessary for proper functioning of the absorption field. Slope and frost action are severe limitations for local roads and streets. Constructing local roads and streets on the contour and shaping of the land overcome the slope limitation. Replacing the upper soil layers or covering them with suitable base material helps control the frost action.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

Wm—Wilbur silt loam, occasionally flooded. This soil is nearly level, deep, and moderately well drained. It is on broad bottom lands. Areas range from 5 to 35 acres.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is brown, friable silt loam, and the lower part is brown, mottled, friable silt loam. The substratum to a depth of about 60 inches is brown, mottled silt loam. In places, the substratum below a depth of 40 inches is loam, fine sandy loam, or loamy fine sand. In places, gray mottles are absent above a depth of 24 inches.

Included with this soil in mapping are narrow, elongated areas of somewhat poorly drained Newark soils in swales and drainageways. The included soils make up about 10 percent of mapped areas.

Available water capacity is high, and permeability is moderate. The organic matter content of the surface layer is moderate, and surface runoff is slow. The surface layer is friable and easy to till through a fairly wide range of soil moisture. The seasonal high water table fluctuates between depths of 3 and 6 feet in winter and early in spring.

Most areas of this soil are used for cultivated crops.

This Wilbur soil is suited to corn and soybeans. Wheat is subject to damage from flooding in winter and early in spring. Occasional flooding is a hazard, and in some years crops need to be replanted because flooding has destroyed stands. Dikes and levees in places help prevent flooding. Subsurface drains are needed in small swales in areas of this soil. Drainage ditches are needed in places to remove excess surface water and provide outlets for subsurface tile. Conservation tillage that leaves protective crop residue on the surface and winter cover crops help maintain the organic matter content and improve tilth.

Grasses and legumes grown for hay and pasture are well suited to this soil, but the soil is seldom used for that purpose. Stands of legumes are damaged in places by occasional flooding. Alfalfa is commonly damaged in swales and drainageways if drainage is not adequate. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is well suited to trees, but it is seldom used for that purpose. Plant competition is the main concern in management of woodlands. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites and sanitary facilities because it is subject to occasional flooding. Flooding and frost action are severe limitations for local roads. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flooding and frost damage.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

Zp—Zipp silty clay, frequently flooded. This soil is nearly level, deep, and very poorly drained. It is on broad, flat lake plains. Areas are irregular in shape and range from 40 to 500 acres.

Typically, the surface layer is dark grayish brown silty clay about 8 inches thick. The subsoil is gray, mottled, very firm silty clay about 37 inches thick. The substratum to a depth of about 60 inches is gray, mottled silty clay. In places the substratum below a depth of 50 inches is stratified silt loam, fine sandy loam, and silty clay loam. loam.

Included with this soil in mapping are small areas of poorly drained Evansville soils that are lower in content of clay and on landscape positions similar to those of this Zipp soil. The included soils make up about 5 percent of mapped areas.

Available water capacity is moderate, and permeability is very slow. The organic matter content of the surface layer is moderate, and surface runoff is very slow. The surface layer becomes cloddy and difficult to work if plowed when too wet or too dry. The seasonal high water table commonly is at or near the surface in winter and early in spring.

Most areas of this soil are used for cultivated crops.

This Zipp soil is suited to corn, soybeans, and small grain. Wetness is a limitation. Drainage has been established in most areas so that crops can be grown. In some years, however, crops need to be replanted because flooding has destroyed stands. A few areas are not drained, and additional drainage is needed. Drainage outlets are difficult to find in places. The very slow permeability restricts the effectiveness of subsurface

drains, and narrow spacings are needed. Land smoothing and shallow surface drains are used to help remove excess surface water. Conservation tillage that leaves crop residue on the surface and the use of green manure crops and cover crops help improve tilth and increase organic matter content. Small grain is subject to damage from the high water table and flooding late in winter and early in spring. Dikes and levees commonly are used to prevent flooding along large streams.

Grasses and legumes for hay and pasture are suited to this soil. The selection of legumes is restricted by seasonal wetness and the flooding hazard. Alfalfa is poorly suited because of wetness and frost heaving. Overgrazing or grazing when the soil is too wet damages the sod, reduces forage yields and plant densities, and causes surface compaction and poor tilth.

This soil is suited to trees, but it is seldom used for woodland. Equipment limitation, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness often delays planting and logging operations until dry seasons or until the ground is frozen. Species that withstand wet conditions are favored in timber stands. Some replanting of seedlings may be needed. Competing vegetation can be controlled by cutting, spraying, or girdling.

This soil is severely limited and is generally not suitable for use as building sites because it is subject to flooding. The flooding, low strength, and wetness are severe limitations for local roads. Replacing the layers of the soil that have high shrink-swell potential with suitable soil material helps overcome the shrink-swell concern. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect the roads from flood damage.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Zs—Zipp silty clay loam, overwash, frequently flooded. This soil is nearly level, deep, and poorly drained. It is on broad, flat lake plains and in depressional areas in the back part of bottom lands. Areas are irregular in shape and range from 40 to 400 acres.

Typically, the surface layer is about 24 inches thick. The upper 10 inches is dark grayish brown, silty clay loam; below this is 8 inches of brown, mottled, friable silty clay loam; and the lower 6 inches is dark gray silty clay. The subsoil is dark gray, mottled, very firm silty clay about 35 inches thick. The substratum to a depth of about 60 inches is gray, mottled, stratified silty clay and silty clay loam.

Included with this soil in mapping are a few small areas of soils that are adjacent to stream channels and have 20 to 30 inches of silt loam overwash. The included soils make up about 5 percent of mapped areas.

Available water capacity is moderate. Permeability is moderately slow in the overwash and very slow in the fine textured subsoil. The organic matter content of the surface layer is moderate, and surface runoff is very slow. The surface layer is friable and easy to work through a fairly wide range of soil moisture. The seasonal high water table commonly is at or near the surface during winter and early in spring.

Most areas of this soil are used for cultivated crops.

This Zipp soil is suited to corn and soybeans. Wetness is a limitation. In some years, crops must be replanted because flooding has destroyed stands. Drainage has been established in most areas so that crops can be grown; however, additional drainage is needed in many areas. Drainage outlets are difficult to find in places. The very slow permeability of the subsoil restricts the effectiveness of subsurface drains. Shallow surface ditches, land smoothing, and grading help remove excess surface water. Conservation tillage that leaves protective crop residue on the surface helps improve the tilth and organic matter content of the surface layer. Small grains are subject to damage from flooding and from the high water table late in winter and early in spring. Dikes and levees help prevent flooding along large streams.

Grasses and legumes grown for hay and pasture are suited to this soil. The selection of legumes is limited by seasonal wetness and flooding. Alfalfa is poorly suited because of wetness and frost heaving. Overgrazing and grazing when the soil is too wet damage the sod and cause surface compaction and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees but is seldom used for woodland. Equipment limitations, seedling mortality, windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting and logging operations and planting of seedlings. Water-tolerant species are favored in timber stands. Some replanting of seedlings is generally needed. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is severely limited and generally not suitable for building sites because of flooding. Flooding, low strength, and wetness are severe limitations for local roads. Replacing layers of the soil with high shrink-swell with suitable soil material helps overcome the shrink-swell limitation. Constructing roads on raised, well compacted fill material and providing adequate side ditches and culverts help protect them from flood damage.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops. If it is properly treated and high level management and acceptable farming methods are used, prime farmland produces the highest yields with minimal inputs of energy and economic resources, and its use results in the least damage to the environment.

Prime farmland in Clay County can now be in cropland, pastureland, woodland, or other land uses but not in urban and, built-up land, or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season and acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 174,000 acres or nearly 75 percent of Clay County meets the soil requirements for prime farmland. Areas are scattered throughout the county and are in all map units of the general soil map. Nearly all of this prime farmland is used for the production of corn and soybeans.

Some parts of the county have been losing prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, difficult to cultivate, and usually less productive.

Soil map units that make up prime farmland in Clay County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed soil map units."

Soils that are limited because of a high water table, flooding, or inadequate rainfall qualify for prime farmland only in areas where these limitations are overcome by such measures as drainage, flood control, or irrigation. In the following list of soils, the measures needed to overcome these limitations, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to determine whether or not these limitations have been overcome by corrective measures.

The map units that meet the soil requirements for prime farmland are:

AvB2—Ava silt loam, 2 to 6 percent slopes, eroded
Ay—Ayrshire fine sandy loam (where drained)
Bo—Bonnie silt loam, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)
Ca—Chagrin silt loam, occasionally flooded
Cb—Chagrin-Stonelick complex, occasionally flooded
CoA—Cory silt loam, 0 to 2 percent slopes (where drained)
Ev—Evansville silt loam, occasionally flooded (where drained)
HbA—Henshaw silt loam, 1 to 3 percent slopes
Ho—Hoosierville silt loam (where drained)
IvA—Iva silt loam, 0 to 2 percent slopes (where drained)
Lo—Lobdell loam, occasionally flooded
Ly—Lyles fine sandy loam (where drained)
Mt—Montgomery Variant silty clay loam (where drained)
MuA—Muren silt loam, 0 to 2 percent slopes
MuB2—Muren silt loam, 2 to 6 percent slopes, eroded
Ne—Newark silt loam, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)
No—Nolin silt loam, rarely flooded
Nr—Nolin silty clay loam, rarely flooded
Pf—Peoga silt loam (where drained)
Pg—Petrolia silty clay loam, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)

PkA—Pike silt loam, 0 to 2 percent slopes

PkB2—Pike silt loam, 2 to 6 percent slopes, eroded

PnB—Princeton fine sandy loam, 2 to 6 percent slopes

Sh—Shoals silt loam, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)

Sk—Steff silt loam, occasionally flooded

Sn—Stendal silt loam, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)

VgA—Vigo silt loam, 0 to 2 percent slopes (where drained)

Wm—Wilbur silt loam, occasionally flooded

Zp—Zipp silty clay, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)

Zs—Zipp silty clay loam, overwash, frequently flooded (where drained and where flooding during the growing season is once or less in 2 years)

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

James D. Glover, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 149,000 acres in Clay County were used for crops and pasture in 1976 (*9*). Of this total, 22,141 acres were used for permanent pasture; 104,900 acres were used for row crops, corn, and soybeans; 16,600 acres were used for close-growing crops, mainly wheat; and 5,400 acres were used for hay.

The potential of the soils is good for increased production of food (*3*). About 6,700 acres of potentially good cropland are currently used as woodland, and about 3,870 acres are used as pasture. Farmers in the area are very progressive in implementing new ideas and technologies for increasing production. Farmers can use the information in this soil survey to plan effective and efficient practices for the production of crops and pasture.

Acreage in crops and pasture has gradually decreased as more and more land is used for development. An estimated 11,330 acres of urban and built-up land is in the county. This figure has been increasing each year. The use of this soil survey to help make land use decisions that influence the future role of farming in the county is discussed in "General soil map units."

Soil drainage is a major problem on 46 percent of the cropland in Clay County. Most of the poorly drained and very poorly drained soils, such as Zipp, Evansville, Peoga, and Hoosierville soils, are capable of producing a crop, but the majority of the acreage is not adequately drained for maximum yields. A few depressional areas of these soils cannot be economically drained because suitable outlets are not available. Most Hoosierville soils are not adequately drained (fig. 11).

The somewhat poorly drained soils are so wet that crops are damaged during most years unless some type of artificial drainage is applied. These somewhat poorly drained soils total 75,700 acres and include Iva, Stendal, and Newark soils.

Pike and Parke soils have good natural drainage most of the year. Erosion can be a problem where slope

exceeds 2 percent. The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of fairly flat, poorly drained and very poorly drained soils used for intensive row cropping. For good drainage, tile needs to be more closely spaced in soils that have slow permeability than in soils that are more permeable. Finding adequate outlets for tile drainage is difficult in many areas of Zipp, Evansville, Peoga, and Hoosierville soils.

Soil erosion is the major soil problem on about 61,000 acres of cropland and pasture in Clay County. If the slope is more than 2 percent, erosion becomes a potential hazard.

Loss of the surface layer through erosion is damaging for many reasons. Productivity is reduced as the surface layer is lost, and subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils with a layer in or below the subsoil that limits the depth of the root zone. An example of this is the fragipan of Cincinnati soils. Erosion also reduces productivity on soils that tend to be somewhat droughty, such as Alvin soils. Performing tillage operations for seedbed preparation is difficult in many sloping fields because the original friable surface soil has been eroded away. This condition is common in areas of severely eroded Cincinnati soils.

Environmental damages occur when soil erosion results in sediment entering streams. Control of erosion minimizes stream pollution by sediment and improves water quality for fish and wildlife and for recreation and municipal uses.

Figure 11.—Installing a plastic line for subsurface drainage in Hoosierville silt loam.

Erosion control practices reduce runoff and increase infiltration. A cropping system that keeps vegetative cover on the soil surface for extended periods helps hold soil erosion losses to tolerable amounts that will not reduce the productive capacity of the soil. On livestock farms that require pasture and hay, the legume and grass forage crops fit into the rotational cropping system to help reduce erosion on sloping land. The legume provides nitrogen for the following year's crop. Extensive root systems on forage crops also help improve tilth.

Many areas in Clay County have short and irregular slopes that do not lend themselves to contour tillage or terracing. In many of these areas, cropping systems that provide substantial vegetative cover are required to control erosion unless conservation tillage is used.

Using conservation tillage and leaving crop residue on the surface are the two main conservation practices used in reducing the hazard of runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the eroded soils and on the soils that have a moderately fine or fine textured surface layer, such as Zipp and Montgomery Variant soils. No-tillage for corn, which is common on an increasing acreage, is effective in reducing erosion on sloping land and can be adapted to most soils in the county. It does have limitations on soils that are wet and slow to warm in spring.

Diversions and parallel tile outlet terraces shorten the effective length of slope and are effective in reducing sheet, rill, and gully erosion. They are most practical on deep, well drained soils with long, uniform slopes. The benefits of terracing include a reduction in soil loss and the associated loss of fertilizer elements; a reduction in sediment problems in water courses; and a reduction in the need for grassed waterways, which take productive land out of row crops. Ava and Muren soils are generally suitable for terracing.

Grassed waterways are needed in almost every area of the county. A waterway is needed on Ava and Cincinnati soils where concentrated runoff flows across them. Generally, subsurface drainage is needed beneath the waterway when it is installed in Iva and Vigo soils. In addition, many of the Ava and Cincinnati soils are seepy along drainageways, and subsurface drains are needed to overcome the seepage.

Grade stabilization structures are needed to help reduce erosion where surface water enters an open ditch. These structures are used to control grade and stabilize the outlets of waterways and diversions.

Soil blowing is not considered a major problem in Clay County; however, it is a hazard on Bloomfield soils in places where they are dry and bare of vegetation. Fall plowed areas of Bloomfield soils are very susceptible to soil blowing. Maintaining a vegetative cover, a surface mulch, or a rough surface through proper tillage minimizes soil blowing.

Soil fertility is naturally low or moderate in most soils on the uplands. The soils on flood plains, such as Chagrin and Shoals soils, are neutral in reaction and are naturally higher in plant nutrients than most upland and terrace soils.

Most upland soils are naturally strongly acid or medium acid. They generally require applications of ground limestone to raise the pH level for good growth of alfalfa and other crops that grow best on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. Additions of lime and fertilizer should be based on the results of a soil test, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is important in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Many of the soils used for crops in the survey area have a silt loam surface layer that is light in color and moderate to low in content of organic matter. Generally, the structure of these soils is moderate or weak, and intense rainfall causes the formation of a crust on the surface. The crust in some areas is hard when dry and impervious to water. Once a hard crust forms, infiltration is reduced and runoff is increased. Regular additions of crop residue, manure, and other organic material help improve tilth and reduce crust formation.

Fall plowing is generally a poor practice on the light colored soils that have a silt loam surface layer. It results in a crust forming during winter and spring, and many of the soils are nearly as dense and hard at planting time as they were before fall plowing. Twenty-six percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in fall.

The Zipp soils are fine textured and moderately fine textured, and tilth is a problem because the soils commonly stay wet until late in spring. If plowed when wet, these soils tend to be very cloddy after they dry, and a good seedbed is difficult to prepare. Fall plowing generally results in good tilth in spring.

Many field crops are suited to the soils and climate of the survey area but are not commonly grown. Corn and soybeans are the main row crops.

Wheat and oats are the common, close-growing crops. Rye could be grown, and grass seed could be produced from fescue, redtop, and bluegrass.

Specialty crops are of limited commercial importance in the survey area. Only a small acreage is used for vegetables and small fruits. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. Examples are Alvin and Princeton soils that have slopes of less than 6 percent. Extent of these soils are about 2,000 acres. Alvin soils need irrigation for optimum production. Crops can generally be planted and

harvested earlier on these soils than on other soils in the survey area.

Most of the well drained soils are suitable for fruit trees and nursery plants. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards. The most up-to-date information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Flooding is a potential problem along the Eel River and along most of the streams in the survey area. Damage to row crops and small grain can be severe when flooding comes in the early part of the growing season.

The Cataract Lake flood-control structure has decreased the potential for flooding during the growing season along the Eel River. Levees are used in places to protect broad bottom lands along the Eel River.

Surface-mined land which is mapped as Fairpoint series totals more than 16,000 acres in Clay County. Most areas are covered by trees and shrubs. Some areas have been partially smoothed and are used for pasture. A few small areas are being cropped. The potential for reclaiming these surface-mined areas for pasture or cropland depends mainly on the amount of hard rock present. Most surface-mined land has enough vegetative cover to adequately control erosion. Some bare and eroding areas are causing sedimentation problems.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland, and for engineering purposes (*6*).

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or

cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used

as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites (fig. 12).

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants (fig. 13).

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates

Figure 12.—A campground in an area of Fairpoint shaly silt loam, 0 to 8 percent slopes, that has been partially smoothed. The water-filled pit provides for boating, fishing, and swimming.

that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are ragweed, goldenrod, wild rye, foxtail, pokeweed, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, beech, cherry, sweetgum, maple, willow, black walnut, hawthorn, dogwood, hickory, hazlenut, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of

Figure 13.—A drainage ditch that is used as an outlet for subsurface tile in an area of Bonnie silt loam. The dense fescue sod on the ditchbanks provides cover and a travel lane for wildlife.

coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, pondweed, wild millet, cattails, algae, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, sloughs and oxbows, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, red fox, woodchuck, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, rails, shore birds, kingfishers, muskrat, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development,

Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness (*11*).

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary

landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile, or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount

of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments more than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than

that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by Indiana State Highway Research and Training Center, Purdue University.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM) (*7*).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sols*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alf*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*8*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Alvin series

The Alvin series consists of deep, well drained soils on uplands. These soils formed in wind-deposited sand and silt. Permeability is moderately rapid. Slope ranges from 4 to 12 percent.

These soils are taxadjuncts because they have somewhat lower base saturation and contain more sand in the lower part of the B horizon than is defined for the Alvin series. This difference does not alter their usefulness or behavior.

Alvin soils are similar to Bloomfield and Princeton soils and are adjacent to Ayrshire, Bloomfield, Lyles, and

Princeton soils. Bloomfield soils contain more sand and less clay in the solum than Alvin soils. Princeton soils contain more clay in the solum. Ayrshire soils have grayish mottled subsoil and contain more clay in the solum. Lyles soils contain more clay in the solum and have a darker surface and grayer subsoil. Princeton and Bloomfield soils are on knolls. Ayrshire soils are on flats and in swales. Lyles soils are in depressions or swales.

Typical pedon of Alvin loamy fine sand, 4 to 12 percent slopes, in a cultivated field; 100 feet north and 900 feet west of center of sec. 25, T. 10 N., R. 7 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; weak very fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A2—9 to 16 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine granular structure; very friable; worm and root channels filled with dark brown (10YR 3/3) loamy fine sand; slightly acid; clear wavy boundary.

B21t—16 to 27 inches; brown (7.5YR 5/4) fine sandy loam; moderate fine subangular blocky structure; very friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

B22t—27 to 45 inches; strong brown (7.5YR 5/6) loamy fine sand; weak medium subangular blocky structure; very friable; 4 inches of dark brown (7.5YR 4/4) sandy loam bands 1 to 2 inches thick; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

B3t—45 to 65 inches; strong brown (7.5YR 5/6) fine sand; weak medium subangular blocky structure; very friable; dark brown (7.5YR 4/4) clay bridges between sand grains; 6 inches of yellowish brown (10YR 5/6) fine sand layers lower in clay and 1 to 2 inches thick; medium acid; gradual wavy boundary.

C—65 to 70 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; medium acid.

The solum ranges from 50 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

A fine sandy loam or loamy fine sand B1 horizon is present in some pedons. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 6. The upper part of the B2t horizon is fine sandy loam or very fine sandy loam. The lower part of the B2t horizon is loamy fine sand or sandy loam and has 4 to 10 inches of loamy fine sand bands. The B3 horizon is loamy fine sand or fine sand. In some pedons, the B3 horizon contains bands of fine sandy loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. It is fine sand or stratified fine sand, fine sandy loam, and loamy fine sand.

Ava series

The Ava series consists of deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in loess and the underlying glacial till. Slope ranges from 2 to 6 percent.

These soils have low chroma mottles higher in the subsoil than is definitive for the Ava series. This difference does not alter the usefulness or behavior of these soils.

Ava soils are similar to Cincinnati and Muren soils and are adjacent to Cincinnati, Hickory, and Iva soils. Muren soils are on knolls and ridgetops, do not have a fragipan, and have more silt and less sand in the lower part of the solum than Ava soils. Well drained Cincinnati soils are on knolls and breaks and have browner subsoil. Hickory soils are in draws and on breaks, do not have a fragipan, and have browner subsoil. Iva soils are on flats between draws, do not have a fragipan, have more silt and less sand in the lower part of the solum, and have grayer subsoil.

Typical pedon of Ava silt loam, 2 to 6 percent slopes, eroded, in an idle field; 700 feet west and 125 feet north of southeast corner sec. 21, T. 10 N., R. 6 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; very pale brown (10YR 7/3) dry; weak medium granular structure; friable; medium acid; abrupt wavy boundary.

A2—5 to 8 inches; light yellowish brown (10YR 6/4) silt loam; weak medium platy structure; friable; medium acid; clear wavy boundary.

B21t—8 to 16 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common medium pores; common discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—16 to 22 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common medium pores; common discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bx1—22 to 32 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct gray (10YR 6/1) and common fine distinct reddish brown (5YR 4/4) mottles; weak coarse prismatic structure parting to moderate thick platy; very firm; brittle; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of prisms; light gray (10YR 7/1) silt flows and films between prisms; strongly acid; clear irregular boundary.

IIBx2—32 to 40 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate thick platy; very firm;

brittle; gray (10YR 6/1) clay and silt films on faces of prisms; light gray (10YR 7/1) silt flows and films between prisms; many black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear irregular boundary.

IIBx3—40 to 58 inches; yellowish brown (10YR 5/4) loam; common medium distinct light gray (10YR 7/1) mottles; weak very coarse prismatic structure; very firm; brittle; light gray (10YR 6/1) clay films on faces of prisms; light gray (10YR 6/1) silt films and flows between prisms; common medium black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear wavy boundary.

IIB3—58 to 80 inches; yellowish brown (10YR 5/4) loam; common medium distinct strong brown (7.5YR 5/6) and light gray (10YR 7/1) mottles; weak coarse prismatic structure; friable; thin patchy light yellowish brown (10YR 6/4) clay films on faces of prisms; light gray (10YR 7/1) silt films on faces of prisms; very strongly acid.

The solum ranges from 60 to 90 inches or more in thickness. The silty loess is 30 to 45 inches thick. The fragipan is at a depth of 20 to 30 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. In places, the A2 horizon has been mixed with the surface layer by plowing.

A silt loam B1 horizon is present in some pedons. The B2t horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 or 6 and is distinctly mottled with chroma of 1 or 2. It is silt loam or silty clay loam. The Bx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8 and is distinctly mottled with chroma of 1 or 2. It is silt loam or loam. The IIB horizon is loam or clay loam.

Ayrshire series

The Ayrshire series consists of deep, somewhat poorly drained, moderately permeable soils on uplands. These soils formed in wind-deposited fine sand and coarse silt. Slope ranges from 0 to 2 percent.

Ayrshire soils are adjacent to Alvin, Bloomfield, Lyles, and Princeton soils. Alvin and Bloomfield soils are browner than Ayrshire soils and have more sand in the solum. Lyles soils have a thicker and darker surface layer, are in swales or depressions, and have a grayish, distinctly mottled solum. Princeton soils have a browner solum. Alvin, Bloomfield, and Princeton soils are on higher positions in the landscape.

Typical pedon of Ayrshire fine sandy loam, in a cultivated field; 1,100 feet north and 150 feet east of center sec. 25, T. 10 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 14 inches; light brownish gray (10YR 6/2) fine sandy loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium platy structure; friable; light gray (10YR 7/2) fine sand coats on faces of peds; neutral; clear wavy boundary.

B21t—14 to 27 inches; yellowish brown (10YR 5/4) loam; many fine distinct light brownish gray (10YR 6/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; light gray (10YR 7/2) fine sandy loam coatings on most faces of prisms; medium acid; gradual wavy boundary.

B22tg—27 to 35 inches; light brownish gray (10YR 6/2) sandy clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; thin light gray (10YR 7/2) fine sandy loam coatings on vertical faces of prisms; common black (10YR 2/1) iron and manganese oxide concretions and stains; strongly acid; gradual wavy boundary.

B23tg—35 to 45 inches; gray (10YR 6/1) sandy clay loam; many fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak coarse and very coarse subangular blocky structure; friable; thin patchy grayish brown (10YR 5/2) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide accumulations; slightly acid; clear wavy boundary.

B3—45 to 55 inches; yellowish brown (10YR 5/6) fine sandy loam; many medium distinct light brownish gray (10YR 6/2) mottles and common fine distinct strong brown (7.5YR 5/6) mottles; weak very coarse subangular blocky structure; friable; common black (10YR 2/1) iron and manganese oxide accumulations; neutral; clear wavy boundary.

C—55 to 60 inches; yellowish brown (10YR 5/4) stratified fine sand and fine sandy loam; common fine distinct light brownish gray (10YR 6/2) mottles; massive and single grain; loose; neutral.

The solum ranges from 45 to 60 inches in thickness. The B2 horizon is mainly medium acid or strongly acid but grades to slightly acid in the lower part.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2. It is fine sandy loam or loam.

A loam or sandy loam B1 horizon is present in some pedons. The B21t horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It has distinct, low chroma

mottles. The B22t and B23t horizons have hue of 10YR, value of 4 to 6, and chroma of 1 or 2 with distinct mottles of higher chroma. They are clay loam or sandy clay loam.

The C horizon is stratified. It is fine sand, fine sandy loam, loam, or silt loam.

Berks series

The Berks series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in residuum from shale and sandstone. Slope ranges from 30 to 70 percent.

Berks soils are adjacent to Gilpin, Hickory, and Wellston soils. Gilpin soils contain fewer sandstone fragments in the solum than Berks soils. Hickory soils do not have so many sandstone fragments in the solum, contain more clay in the B horizon, and are underlain with glacial till. Wellston soils have a thicker solum and contain fewer sandstone fragments in the upper part of the profile. All of these soils are in draws or on knolls.

Typical pedon of Berks channery silt loam, in an area of Berks-Gilpin complex, 30 to 70 percent slopes, in woods; 600 feet west and 1,800 feet north of southeast corner sec. 16, T. 11 N., R. 5 W.

O1—1/2 inch to 0; partially decomposed leaf litter.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) channery silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; 20 percent sandstone fragments; strongly acid; clear wavy boundary.

A2—3 to 7 inches; yellowish brown (10YR 5/4) channery loam; weak medium platy structure parting to weak very fine subangular blocky; friable; many fine roots; worm and root channels filled with very dark grayish brown (10YR 3/2) silt loam; 30 percent sandstone fragments; very strongly acid; clear wavy boundary.

B1—7 to 11 inches; yellowish brown (10YR 5/6) channery loam; weak fine subangular blocky structure; friable; many fine roots; 35 percent sandstone fragments; very strongly acid; clear wavy boundary.

B21—11 to 24 inches; yellowish brown (10YR 5/6) very channery loam; weak fine subangular blocky structure; friable; common fine roots; 50 percent sandstone fragments; very strongly acid; gradual wavy boundary.

B22—24 to 32 inches; yellowish brown (10YR 5/6) very channery loam; weak medium subangular blocky structure; friable; few fine roots; 50 percent sandstone fragments; very strongly acid; gradual wavy boundary.

C—32 to 38 inches; yellowish brown (10YR 5/6) very channery loam; massive; friable; 60 percent sandstone fragments; very strongly acid; abrupt irregular boundary.

Cr—38 inches; interbedded fractured sandstone and shale bedrock; cracks filled with yellowish brown (10YR 5/4) loam; very strongly acid.

The solum ranges from 24 to 36 inches in thickness, and bedrock is at a depth of 24 to 40 inches. Average content of coarse fragments in the B horizon is 45 to 70 percent.

The A1 horizon has hue of 10YR and value and chroma of 2 or 3. It is silt loam, channery silt loam, or channery loam.

The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 6. It is channery silt loam, very channery loam, or channery loam. A B3 horizon is present in some pedons.

The C horizon is channery loam, very channery loam, shaly loam, or shaly silt loam. The Cr horizon is mostly shale in some pedons. The content of loam or sandy loam soil material filling cracks between rock fragments in the Cr horizon ranges from 3 to 15 percent by volume.

Bloomfield series

The Bloomfield series consists of deep, well drained and somewhat excessively drained soils on uplands. These soils formed in wind-deposited sand. Permeability is rapid or moderately rapid. Slope ranges from 12 to 50 percent.

The argillic horizon in these soils is at less depth and has more clay than is definitive for the Bloomfield series. These differences do not alter the usefulness or behavior of these soils.

Bloomfield soils are similar to Alvin soils and are adjacent to Ayrshire, Lyles, and Princeton soils. Alvin soils have more clay in the B horizon than Bloomfield soils. Ayrshire soils have a grayish mottled subsoil and more clay in the solum. Lyles soils have a thicker, darker surface layer, grayer subsoil, and more clay in the solum. Princeton soils contain more clay in the solum. Alvin and Princeton soils are on knolls. Ayrshire soils are on flats and in swales. Lyles soils are in depressions and swales.

Typical pedon of Bloomfield loamy fine sand, 12 to 18 percent slopes, in a cultivated field; 300 feet east and 450 feet south of northwest corner sec. 10, T. 11 N., R. 6 W.

Ap—0 to 9 inches; brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

A2—9 to 17 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine granular structure; very friable; many fine roots; medium acid; clear irregular boundary.

B2t—17 to 28 inches; dark brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; few fine roots; discontinuous reddish brown (5YR 4/4) clay films bridging between sand grains; slightly acid; clear irregular boundary.

A&B—28 to 52 inches; yellowish brown (10YR 5/6) loamy fine sand interbands 3 to 8 inches thick, A part; weak coarse subangular blocky structure; very friable; continuous bands and pockets of dark brown (7.5YR 4/4) fine sandy loam that total 5 inches in thickness, B2t part; discontinuous reddish brown (5YR 4/4) clay films on faces of peds and bridging between sand grains; medium acid; gradual irregular boundary.

B&A—52 to 75 inches; brown (7.5YR 5/4) loamy fine sand in nearly continuous bands 3 to 6 inches thick, B2t part; weak coarse subangular blocky structure; very friable; patchy dark brown (7.5YR 4/4) clay bridges between sand grains; discontinuous interbands and rounded masses of yellowish brown (10YR 5/4) fine sand 1/2 inch to 2 inches thick, A part; medium acid; gradual irregular boundary.

C—75 to 80 inches; brown (7.5YR 4/4) fine sand; single grain; loose; slightly acid.

The solum ranges from 60 to 80 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

A loamy fine sand B1 horizon is present in some pedons. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 6. This horizon is 10 to 15 percent clay and 80 to 90 percent sand. It is medium acid or slightly acid. In the A&B horizon, the A part has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. The B2t part of the A&B horizon has hue of 7.5YR or 10YR, value 4 or 5, and chroma of 4 or 6. It is 3 to 10 inches thick. The A&B horizon is medium acid or slightly acid. In the B&A horizon, the B2t part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 or 6. The B2t part is loamy fine sand or sandy loam and has 10 to 15 percent clay and 80 to 90 percent sand. The A part of the B&A horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. The B&A horizon is medium acid or slightly acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 6. It is slightly acid or neutral.

Bonnie series

The Bonnie series consists of deep, poorly drained and very poorly drained, moderately permeable soils on bottom lands. These soils formed in silty, acid alluvium. Slope is 0 to 1 percent.

Bonnie soils are commonly near Newark, Peoga, and Stendal soils. Newark and Stendal soils are on bottom lands and are browner than Bonnie soils. Newark soils are less acid. Peoga soils have more clay in the subsoil.

Typical pedon of Bonnie silt loam, frequently flooded, in a cultivated field; 2,200 feet west and 70 feet north of southeast corner sec. 35, T. 11 N., R. 7 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; light gray (10YR 7/2) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

C1g—8 to 21 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; friable; common fine roots; tubular tongues and crack fillings of light gray (10YR 7/2) silt; strongly acid; clear wavy boundary.

C2g—21 to 35 inches; light gray (10YR 7/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; few fine roots; tubular tongues and vertical seams of light gray (10YR 7/2) silt; common fine dark reddish brown (5YR 3/4) iron and manganese oxide concretions; strongly acid; gradual wavy boundary.

C3g—35 to 50 inches; light gray (10YR 7/2) silt loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; slightly brittle when dry; few vertical seams of light gray (10YR 7/2) silt; few dark reddish brown (5YR 3/4) iron and manganese oxide concretions; strongly acid; gradual wavy boundary.

C4g—50 to 60 inches; light gray (10YR 7/2) silt loam; common fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; slightly brittle when dry; few vertical seams of light gray (10YR 7/2) silt loam; dark reddish brown (5YR 3/4) iron and manganese oxide concretions; strongly acid.

The Ap horizon has hue of 10YR, value of 5 or 6, and chroma of 2. In wooded areas an A1 horizon is present.

The C horizon has hue of 10YR or 2.5Y, value of 6 or 7, and chroma of 1 or 2 or is neutral and has value of 6 or 7. It contains distinct mottles of higher chroma. The C horizon above a depth of 40 inches is strongly acid or very strongly acid. The C horizon below a depth of 40 inches is strongly acid or medium acid, and in some pedons, contains strata of loam, sandy loam, fine sand, or silty clay loam.

Chagrin series

The Chagrin series consists of deep, well drained, moderately permeable soils on bottom lands. These soils formed in loamy and silty alluvium. Slope is 0 to 1 percent.

These soils have less clay than is definitive for the Chagrin series. This difference does not alter the usefulness or behavior of these soils.

Chagrin soils are similar to Nolin and Wilbur soils and are commonly adjacent to Lobdell and Stonelick soils. Nolin soils have more clay and less sand throughout the profile than Chagrin soils. Wilbur soils have grayish mottles and less sand in the substratum. Lobdell soils have grayish mottles in the substratum. Stonelick soils have more sand and less silt in the substratum. All of these soils are on bottom lands.

Typical pedon of Chagrin silt loam, occasionally flooded, in a cultivated field; 750 feet east and 350 feet south of center sec. 33, T. 11 N., R. 6 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

B21—8 to 18 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; few fine pores; neutral; clear wavy boundary.

B22—18 to 30 inches; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure parting to moderate medium granular; friable; common fine pores; thin patchy dark brown (10YR 4/3) silt loam coatings on faces of peds and filling vertical voids; neutral; clear wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; yellowish brown (10YR 5/4) loamy fine sand and loam bands 1/2 inch to 2 inches thick, 5 inches combined thickness of loamy fine sand bands and 3 inches combined thickness of loam; neutral.

The soil is slightly acid or neutral in the upper 30 inches and neutral below this depth.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or loam.

The C horizon is fine sandy loam or loam with thin strata of silt loam, loamy fine sand, or very fine sand. It commonly becomes coarser in texture as depth increases.

Chetwynd series

The Chetwynd series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy outwash. Slope ranges from 25 to 70 percent.

Chetwynd soils are commonly near Parke and Pike soils. Parke and Pike soils have more silt in the upper part of the solum than Chetwynd soils and are on knolls and in draws.

Typical pedon of Chetwynd loam, 25 to 70 percent slopes, in woods; 1,500 feet east and 50 feet south of northwest corner sec. 13, T. 13 N., R. 6 W.

O—1/2 inch to 0; partly decomposed leaf litter; very strongly acid.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; very strongly acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) loam; moderate fine granular structure; friable; worm and root channels filled with dark grayish brown (10YR 4/2) loam; very strongly acid; clear wavy boundary.

B1—6 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; strongly acid; clear wavy boundary.

B21t—12 to 18 inches; yellowish red (5YR 4/6) sandy clay loam; moderate fine and medium subangular blocky structure; firm; voids filled with brown (10YR 5/3) loam; patchy reddish brown (5YR 4/4) clay films on faces of peds; about 7 percent fine gravel; very strongly acid; clear wavy boundary.

B22t—18 to 26 inches; yellowish red (5YR 5/6) sandy loam; moderate medium subangular blocky structure; friable; thick reddish brown (5YR 4/4) clay films on most faces of peds; about 7 percent fine gravel; very strongly acid; gradual wavy boundary.

B23t—26 to 34 inches; yellowish red (5YR 5/8) sandy loam; weak medium subangular blocky structure; friable; thin patchy reddish brown (5YR 4/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

B24t—34 to 46 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable; common small masses of yellowish red (5YR 4/6) sandy loam; thin patchy reddish brown (5YR 4/4) clay films on most faces of peds; about 10 percent gravel; very strongly acid; gradual wavy boundary.

B25t—46 to 60 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; friable; few small masses of yellowish red (5YR 4/6) sandy loam; thin patchy reddish brown (5YR 4/4) clay films; about 7 percent gravel; few very dark brown (7.5YR 2/2) iron and manganese oxide accumulations and stains; very strongly acid; gradual wavy boundary.

B3t—60 to 80 inches; strong brown (7.5YR 5/6) sandy loam; weak very coarse subangular blocky structure; very friable; thin patchy reddish brown (5YR 4/4) clay films and bridges between sand grains; bands of light yellowish brown (10YR 6/4) fine sand; single grain; loose; strongly acid.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is loam or silt loam. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B1 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The B2t horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is strongly acid or very strongly acid. The upper part of the B2 horizon is sandy clay loam or gravelly sandy clay loam, and the lower part is sandy loam or sandy loam with sandy clay loam bands. The B3 horizon extends to a depth of 80 to 130 inches. It is neutral below a depth of 100 inches in some pedons.

Cincinnati series

The Cincinnati series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in loess and the underlying glacial till. Slope ranges from 6 to 12 percent.

Cincinnati soils are similar to Ava soils and commonly near Hickory and Iva soils. Ava soils are on knolls and have a brownish mottled subsoil. Hickory soils are in draws or on breaks, do not have a fragipan, and have less silt in the upper part of the solum than Cincinnati soils. Iva soils are on flats, do not have a fragipan, have more silt in the lower part of the solum, and have a grayish mottled subsoil.

Typical pedon of Cincinnati silt loam, 6 to 12 percent slopes, severely eroded, in a cultivated field; 550 feet west and 1,075 feet south of northeast corner sec. 26, T. 12 N., R. 6 W.

Ap—0 to 7 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; weak very fine subangular blocky structure; friable; many small masses of yellowish brown (10YR 5/6) silt loam; medium acid; abrupt smooth boundary.

B21t—7 to 14 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; many discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—14 to 21 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; many continuous dark brown (7.5YR 4/4) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains and accumulations; very strongly acid; clear wavy boundary.

IIBx1—21 to 31 inches; yellowish brown (10YR 5/6) loam; common fine distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/8) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very firm; brittle when dry; thick continuous dark brown (7.5YR 4/4) clay films on faces of prisms and thin patchy dark brown (7.5YR 4/4) clay films on faces of subangular blocky peds; thin continuous light yellowish brown (10YR 6/4) silt coatings on surfaces of peds and filling vertical cracks; few fine pebbles; few black (10YR 2/1) iron and manganese oxide stains; very strongly acid; gradual wavy boundary.

IIBx2—31 to 42 inches; yellowish brown (10YR 5/6) loam; common fine distinct pale brown (10YR 6/3) mottles; moderate coarse prismatic structure; very firm; brittle when dry; thin continuous dark brown (7.5YR 4/4) clay films on vertical faces of prisms and thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; thick continuous light yellowish brown (10YR 6/4) silt coatings on faces of prisms; few fine pebbles; few black (10YR 2/1) iron and manganese oxide stains; very strongly acid; gradual wavy boundary.

IIBx3—42 to 56 inches; yellowish brown (10YR 5/6) clay loam; common fine distinct gray (10YR 6/1) mottles; moderate coarse and very coarse prismatic structure; very firm; brittle when dry; common patchy dark brown (7.5YR 4/4) clay films on faces of peds; light brownish gray (10YR 6/2) silt coatings on faces of prisms; few fine pebbles; few black (10YR 2/1) iron and manganese oxide stains and accumulations; strongly acid; gradual wavy boundary.

IIB3—56 to 68 inches; yellowish brown (10YR 5/4) loam; few fine distinct gray (10YR 6/1) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; friable; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; thin patchy pale brown (10YR 6/3) silt coatings on faces of prisms; few fine pebbles; few very dark brown (10YR 2/2) iron and manganese oxide stains and concretions; strongly acid; gradual wavy boundary.

IIC—68 to 80 inches; yellowish brown (10YR 5/6) clay loam; massive; friable; gray (10YR 5/1) clay films lining pores; few black (10YR 2/1) iron and manganese oxide stains and concretions; few fine pebbles; strongly acid.

The thickness of loess is 18 to 40 inches. The fragipan is at a depth of 24 to 36 inches in noneroded pedons and 18 to 24 inches in severely eroded pedons.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6 in severely eroded pedons and hue of 10YR, value of 4 or 5, and chroma of 2 or 3 in pedons where most of the original surface soil remains. The Ap horizon has 23 to 27 percent clay in severely eroded pedons. The A2 and B1 horizons are present in most pedons that are not severely eroded.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The IIBx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It has distinct mottles of lower chroma. The IIBx horizon is less than 30 percent clay. The IIC horizon is loam or clay loam.

Cincinnati Variant

The Cincinnati Variant consists of deep, well drained, very slowly permeable soils on uplands. These soils formed in loess and glacial till that contains material from sandstone and shale bedrock. Slope ranges from 6 to 12 percent.

Cincinnati Variant soils are commonly near Cincinnati, Gilpin, and Hickory soils. Cincinnati soils do not have bedrock residuum in the upper part of the substratum and are on breaks along drainageways and on knolls. Gilpin soils have more sand and sandstone fragments in the subsoil and substratum than Cincinnati Variant soils and do not have a fragipan. Hickory soils have less silt

and more sand in the solum and do not have a fragipan. Hickory and Gilpin soils are in draws and on breaks. Cincinnati soils are on breaks and on knolls or ridges. Gilpin and Hickory soils are in draws or on knolls.

Typical pedon of Cincinnati Variant silt loam, 6 to 12 percent slopes, severely eroded, in a cultivated field; 400 feet west and 400 feet south of northeast corner sec. 19, T. 12 N., R. 5 W.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam, very pale brown (10YR 7/4) dry; many small masses of yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; medium acid; abrupt smooth boundary.

B21t—6 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on most faces of peds; strongly acid; clear wavy boundary.

B22t—12 to 20 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; continuous dark brown (7.5YR 4/4) clay films on most faces of peds; very strongly acid; clear irregular boundary.

IIBx1—20 to 30 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure parting to moderate very thick platy; very firm; brittle; continuous brown (7.5YR 4/4) clay films on faces of prisms and horizontal surfaces of plates; 2 to 5 millimeters thick light brownish gray (10YR 6/2) silt flows and coatings between prisms; common black (10YR 2/1) iron and manganese oxide concretions; strongly acid; clear irregular boundary.

IIBx2—30 to 50 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure; very firm; brittle; thin discontinuous brown (7.5YR 4/4) clay films on faces of prisms; 2 to 5 millimeters thick light brownish gray (10YR 6/2) silt flows between prisms; 2 percent fine gravel and 3 percent sandstone fragments; strongly acid; clear irregular boundary.

IIIB23tb—50 to 68 inches; strong brown (7.5YR 5/6) clay loam; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; thick continuous reddish brown (5YR 5/4) clay films on faces of peds; few light yellowish brown (10YR 6/4) silt flows between prisms; 5 percent gravel (glacial pebbles) and 2 percent sandstone fragments; strongly acid; gradual wavy boundary.

IIIB24b—68 to 80 inches; strong brown (7.5YR 5/6) clay loam; weak coarse prismatic structure parting to weak fine subangular blocky; firm; 5 percent gravel (glacial pebbles) and 5 percent sandstone fragments; dark brown (7.5YR 4/4) clay films on vertical faces of prisms; very strongly acid.

The upper part of the solum formed in 18 to 40 inches of loess. The fragipan is at a depth of 20 to 36 inches in noneroded pedons. Sandstone and shale bedrock is at a depth of 6 to 10 feet.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6 in severely eroded areas and hue of 10YR, value of 4 or 5, and chroma of 2 to 4 in areas where most of the original surface soil remains. The Ap horizon has 23 to 27 percent clay in severely eroded units. The A2 and B1 horizons are present in most less eroded pedons.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is silty clay loam or silt loam. The IIBx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The IIBx horizon is silt loam, loam, or clay loam, has distinct mottles, and is less than 30 percent clay. The IIIB2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 or 6. It is clay loam or loam.

Cory series

The Cory series consists of deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slope ranges from 0 to 2 percent.

Cory soils are similar to Iva soils and are commonly adjacent to Hoosierville and Muren soils. Hoosierville, Iva, and Muren soils have a lighter colored surface horizon than Cory soils. Iva soils have a somewhat browner subsoil. Iva and Hoosierville soils are on flats. Muren soils are on higher lying positions and have a browner subsoil.

Typical pedon of Cory silt loam, 0 to 2 percent slopes, in a cultivated field; 180 feet east and 1,900 feet north of southwest corner sec. 16, T. 11 N., R. 7. W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

A2—7 to 14 inches; dark grayish brown (10YR 4/2) silt loam, gray (10YR 6/1) dry; few medium distinct strong brown (7.5YR 5/6) mottles; weak thick platy structure parting to moderate fine subangular blocky; friable; common roots; thin very dark gray (10YR 3/1) clay and organic coatings on faces of peds; few reddish brown (2.5YR 4/4) iron and manganese oxide accumulations; neutral; clear wavy boundary.

B21tg—14 to 29 inches; gray (10YR 5/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common medium pores; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; very dark gray (10YR 3/1) organic and clay fillings in vertical cracks; few tubular tongues of dark gray (10YR 4/1) silt loam; few very dark gray (10YR

3/1) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

B22tg—29 to 42 inches; light gray (10YR 6/1) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few fine pores; discontinuous gray (10YR 5/1) clay films on faces of peds; very dark gray (10YR 3/1) organic and clay coatings on vertical cracks; few very dark gray (10YR 3/1) iron and manganese oxide accumulations; medium acid; clear irregular boundary.

B3g—42 to 65 inches; light gray (10YR 6/1) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; firm; few thin very dark gray (10YR 3/1) organic and clay coatings on vertical cracks; few very dark gray (N 3/0) iron and manganese oxide accumulations; medium acid; clear irregular boundary.

C—65 to 70 inches; light gray (N 7/0) stratified silt loam, silty clay loam, and clay loam; many fine distinct olive yellow (2.5Y 6/6) and yellowish brown (10YR 5/8) mottles; massive; friable; few very dark gray (N 3/0) iron and manganese oxide accumulations; slightly acid.

The solum ranges from 50 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 3, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2.

A silt loam B1g horizon is present in some pedons. The B3tg horizon is silt loam or silty clay loam. The C horizon is silt loam or stratified silt loam, silty clay loam, and clay loam and is slightly acid or neutral.

Evansville series

The Evansville series consists of deep, poorly drained, moderately permeable soils on low terraces. These soils formed in stratified, silty sediment. Slope is 0 to 1 percent.

Evansville soils are similar to Petrolia soils and are adjacent to Montgomery Variant, Peoga, and Zipp soils. Montgomery Variant soils have a thicker, darker surface layer than Evansville soils. Peoga soils are more acid and have an argillic horizon. Petrolia soils are flooded more frequently and are on bottom lands. Montgomery Variant and Zipp soils have more clay in the solum than Evansville soils. All of these soils are on low terraces or lake plains.

Typical pedon of Evansville silt loam, occasionally flooded, in a cultivated field; 900 feet west and 1,000 feet south of center of sec. 4, T. 10 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common medium roots; neutral; abrupt smooth boundary.

B1g—8 to 17 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few fine pores; few reddish brown (5YR 4/4) iron and manganese oxide accumulations; neutral; clear wavy boundary.

B21g—17 to 30 inches; gray (10YR 5/1) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; firm; few fine pores; thin patchy gray (10YR 4/1) coatings on faces of peds; numerous black (10YR 2/1) iron and manganese oxide stains and accumulations; slightly acid; gradual wavy boundary.

B22g—30 to 38 inches; gray (10YR 5/1) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium angular blocky structure; firm; few fine pores; thin patchy dark gray (10YR 4/1) coatings on faces of peds; numerous black (10YR 2/1) iron and manganese oxide accumulations; slightly acid; gradual wavy boundary.

B23g—38 to 48 inches; gray (10YR 6/1) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; thin patchy dark gray (10YR 4/1) coatings on faces of peds; numerous black (10YR 2/1) iron and manganese accumulations; slightly acid; gradual wavy boundary.

Cg—48 to 60 inches; gray (10YR 6/1) stratified silt loam and silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8) mottles; massive; friable; slightly acid.

The solum ranges from 40 to 50 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The B1g horizon is silt loam or silty clay loam. The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It has distinct mottles. In some pedons the B2g horizon has prismatic structure and patchy clay films on vertical faces of prisms. A silt loam or silty clay loam B3g horizon is in some pedons.

The C horizon ranges from silt loam and silty clay loam to stratified silty clay loam, silt loam, loam, and fine sandy loam.

Fairpoint series

The Fairpoint series consists of deep, well drained soils on uplands. These soils formed in spoil from surface mining. Permeability is moderately slow. Slope ranges from 0 to 90 percent.

Fairpoint soils are commonly near Ava, Hickory, Iva, and Vigo soils. These nearby soils have more clay in the subsoil than Fairpoint soils and do not have sandstone

and shale fragments in the solum. Also, Ava soils have a fragipan, and Iva and Vigo soils have a grayer subsoil.

Typical pedon of Fairpoint shaly silty clay loam, 33 to 90 percent slopes, in a sparsely wooded area; 875 feet east and 1,700 feet south of northwest corner sec. 4, T. 11 N., R. 6 W.

A1—0 to 2 inches; very dark gray (10YR 3/1) shaly silty clay loam, gray (10YR 5/1) dry; weak medium granular structure; friable; many fine roots; 3 percent sandstone fragments; 30 percent dark gray (10YR 4/1) fine very soft weathered shale fragments; 10 percent yellowish brown (10YR 5/6) silty clay loam and clay loam masses; neutral; clear wavy boundary.

C1—2 to 8 inches; dark gray (10YR 4/1) very shaly silty clay loam; massive; friable; many fine roots; 3 percent sandstone and hard shale fragments; 50 percent dark gray (10YR 4/1) very soft weathered shale fragments; 10 percent yellowish brown (10YR 5/6) silty clay loam and clay loam masses; neutral; gradual wavy boundary.

C2—8 to 24 inches; dark gray (10YR 4/1) very shaly silty clay loam; massive; friable; common fine roots; 25 percent sandstone and hard shale fragments; 50 percent soft partially weathered shale fragments; 10 percent yellowish brown (10YR 5/6) silty clay loam and clay loam masses; few coal fragments; neutral; abrupt irregular boundary.

C3—24 to 60 inches; dark gray (N 4/0) partially weathered soft shale fragments; 10 percent sandstone and hard shale fragments; 10 percent yellowish brown (10YR 5/6) clay loam and silty clay loam masses; 10 percent very soft weathered shale fragments, silty clay loam rubbed; neutral.

The soil is medium acid to neutral throughout. It is 20 to 80 percent coarse fragments that mainly are 2 to 10 inches across but range to large stones. The coarse fragments are dominantly soft or very soft shale but include hard shale and sandstone and till pebbles.

The A1 horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 1 to 6. It is shaly silty clay loam, shaly silt loam, loam, silt loam, silty clay loam, or clay loam. The A1 horizon is 1 to 4 inches thick and has weak or moderate, medium or coarse granular structure. In some reclaimed areas the A horizon consists of 4 to 8 inches of silt loam or loam.

The C horizon to a depth of 24 inches is shaly or very shaly silty clay loam, clay loam, loam, or silt loam. Shale fragments are mostly soft or very soft. Hard coarse fragments, such as sandstone, hard shale, and till pebbles, make up 5 to 20 percent of the upper part of the C horizon. The lower part of the C horizon is dominantly soft shale fragments. It can contain 5 to 40 percent hard shale or sandstone fragments and 5 to 40 percent masses of loam, silt loam, clay loam, or silty clay loam.

Gilpin series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in residuum from sandstone and shale. Slope ranges from 18 to 70 percent.

These soils do not have enough clay differential to qualify for an argillic horizon required for the Gilpin series. This difference does not alter the usefulness or behavior of these soils.

Gilpin soils are commonly near Berks, Hickory, and Wellston soils. Berks soils have more sandstone fragments in the solum than Gilpin soils. Hickory soils do not have sandstone fragments in the solum, contain more clay in the B horizon, and are underlain with glacial till. Wellston soils have a thicker solum and contain fewer sandstone fragments. All of these soils are in draws or on knolls.

Typical pedon of Gilpin silt loam, in an area of Berks-Gilpin complex, 30 to 70 percent slopes, in woods; 650 feet west and 1,800 feet north of southeast corner sec. 16, T. 11 N., R. 5 W.

O1—1/2 inch to 0; partly decomposed leaf litter.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; 15 percent sandstone fragments; strongly acid; abrupt wavy boundary.

A2—4 to 8 inches; brown (10YR 4/3) silt loam; weak medium platy structure parting to weak fine granular; friable; many fine roots; 15 percent sandstone fragments; very dark grayish brown (10YR 3/2) silt loam fillings in worm and root channels; strongly acid; clear wavy boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many fine roots; many medium pores; discontinuous brown (7.5YR 5/4) clay films on many faces of peds; 15 percent sandstone fragments; very strongly acid; clear wavy boundary.

B22t—13 to 24 inches; yellowish brown (10YR 5/6) channery loam; moderate medium subangular blocky structure; friable; few roots; few fine pores; discontinuous brown (7.5YR 5/4) clay films on most faces of peds; 20 percent sandstone fragments; very strongly acid; gradual wavy boundary.

B3—24 to 30 inches; yellowish brown (10YR 5/6) channery loam; few fine distinct yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; friable; few roots; few light yellowish brown (10YR 6/4) silt loam coatings on faces of peds; 20 percent sandstone fragments; very strongly acid; clear wavy boundary.

C—30 to 35 inches; yellowish brown (10YR 5/4) channery loam; massive; friable; few roots; 35 percent sandstone fragments; very strongly acid; clear irregular boundary.

Cr—35 to 50 inches; interbedded fractured sandstone and shale bedrock; cracks filled with light yellowish brown (10YR 6/4) shaly loam; very strongly acid; clear smooth boundary.
R—50 inches; sandstone and shale bedrock.

The solum ranges from 24 to 36 inches in thickness, and bedrock is at a depth of 24 to 40 inches. Average content of coarse fragments in the B horizon is 15 to 25 percent.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is silt loam, loam, or channery loam.

A B1 horizon is present in some pedons. The B2 horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6. It is silt loam, loam, or channery loam. The B3 horizon is absent in some pedons.

The C horizon is channery loam, shaly loam, or shaly silt loam. In some pedons, the Cr horizon is mainly shale. The content of loam, shaly loam, or sandy loam material filling cracks between rock fragments in the Cr horizon ranges from 3 to 15 percent by volume.

Henshaw series

The Henshaw series consists of deep, somewhat poorly drained soils on low terraces. These soils formed in silty sediment. Permeability is moderately slow. Slope ranges from 1 to 3 percent.

These soils are more acid in the lower part of the subsoil and substratum and have lower base status than is definitive for the Henshaw series. These differences do not alter the usefulness or behavior of these soils.

Henshaw soils are adjacent to Evansville, Peoga, and Stendal soils. Evansville and Peoga soils have a grayer subsoil and are on adjacent flats. Stendal soils have a grayer subsoil, are on lower lying bottom lands, and consist of silty alluvium.

Typical pedon of Henshaw silt loam, 1 to 3 percent slopes, in a cultivated field; 175 feet north and 1,500 feet west of southeast corner sec. 23, T. 11 N., R. 6 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; pale brown (10YR 6/3) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A2—7 to 13 inches; pale brown (10YR 6/3) silt loam; common fine distinct dark yellowish brown (10YR 3/4) and common fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; fillings in root channels of brown (10YR 4/3) silt loam; few black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.
B21t—13 to 24 inches; pale brown (10YR 6/3) silt loam; many fine faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/4) clay films on most faces of peds; strongly acid; clear wavy boundary.
B22t—24 to 38 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) silt loam; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous brown (10YR 5/3) clay films on most faces of peds; thin light brownish gray (10YR 6/2) silt films on faces of peds; common black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; gradual wavy boundary.
B23t—38 to 50 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous grayish brown (10YR 5/2) clay films on most faces of peds; thin light gray (10YR 7/1) silt and clay coatings on faces of prisms; common black (10YR 2/1) iron and manganese oxide stains and accumulations; strongly acid; gradual wavy boundary.
B3t—50 to 60 inches; yellowish brown (10YR 5/6) silt loam; many fine distinct light gray (10YR 7/1) mottles; weak coarse prismatic structure; friable; thick light gray (10YR 7/1) silt and clay flows on faces of prisms; few dark reddish brown (5YR 3/3) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.
C—60 to 70 inches; yellowish brown (10YR 5/6) stratified silt loam and silty clay loam; many fine distinct light gray (10YR 7/1) and common fine distinct yellowish red (5YR 4/6) mottles; massive; friable; few black (10YR 2/1) iron and manganese oxide accumulations; medium acid.

The solum ranges from 48 to 60 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A2 horizon commonly is absent because it has been mixed with the Ap by plowing.

A B1 horizon is present in some pedons. The upper part of the B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 6 and is mottled. The lower part of the B2t horizon and the B3t horizon have hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. They are silt loam or silty clay loam and medium acid or strongly acid.

The C horizon is silt loam or silty clay loam and medium acid or slightly acid.

Hickory series

The Hickory series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin layer of loess and loamy glacial till, or in loamy glacial till. Slope ranges from 12 to 70 percent.

Hickory soils are commonly adjacent to Ava, Cincinnati, and Muren soils. Ava and Cincinnati soils have more silt in the upper part of the solum than

Hickory soils, have a fragipan, and are on adjacent knolls and ridgetops. Muren soils have more silt throughout the solum and are on knolls and ridgetops.

Typical pedon of Hickory loam, 18 to 25 percent slopes, in woods; 1,800 feet east and 200 feet south of northwest corner sec. 1, T. 13 N., R. 6 W.

O—1/2 inch to 0; partly decomposed leaf litter; very strongly acid.

A1—0 to 2 inches; very dark brown (10YR 2/2) loam; dark grayish brown (10YR 4/2) dry; weak; very fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

A2—2 to 6 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable; many fine roots; very dark gray (10YR 3/1) loam fillings in worm and root channels; very strongly acid; clear smooth boundary.

B1—6 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; many fine roots; 3 percent fine gravel; very strongly acid; clear wavy boundary.

B21t—16 to 31 inches; strong brown (7.5YR 5/6) clay loam; moderate fine subangular blocky structure; firm; common fine roots; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 3 percent fine gravel; very strongly acid; gradual wavy boundary.

B22t—31 to 41 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; firm; few medium roots; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 3 percent fine gravel; very strongly acid; gradual wavy boundary.

B23t—41 to 50 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium and coarse subangular blocky structure; firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 5 percent fine gravel; clean sand grains on surface of peds; medium acid; gradual wavy boundary.

B3—50 to 56 inches; yellowish brown (10YR 5/4) loam; common fine faint yellowish brown (10YR 5/8) mottles; massive; friable; few patchy brown (7.5YR 4/4) clay films in vertical cracks; 5 percent fine gravel; black (10YR 2/1) iron and manganese oxide concretions; few moderately alkaline spots; weak effervescence; neutral; gradual wavy boundary.

C—56 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; 5 percent fine gravel; strong effervescence; moderately alkaline.

The solum ranges from 48 to 72 inches in thickness.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It is loam or silt loam. Areas that have been cleared and cultivated have an Ap horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The A2 horizon is absent in pedons because it has been mixed into the Ap by plowing. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. It is loam or silt loam.

The B1 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is loam or silt loam. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The B3 horizon has hue of 10YR, value of 5, and chroma of 3 to 6. It is clay loam, loam, or sandy clay loam.

The C horizon is loam, clay loam, or sandy loam.

Map units HcD and HcD3 are outside the range of the Hickory series because the solum is leached of carbonates to a greater depth than is definitive for the series. Map unit HcF is outside the range of the series because the soil is shallower to the mildly alkaline substratum than is definitive for the series. These differences do not alter the usefulness or behavior of these soils.

Hoosierville series

The Hoosierville series consists of deep, poorly drained soils on uplands. These soils formed in loess. Permeability is moderately slow. Slope ranges from 0 to 2 percent.

Hoosierville soils are similar to Peoga and Vigo soils and adjacent to Ava, Cincinnati, Iva, and Muren soils. Peoga soils have more clay in the lower part of the solum than Hoosierville soils and are on lower positions in the landscape. Vigo soils have less silt and more sand in the lower part of the solum and are on flats and ridgetops. Iva soils are browner in the upper part of the subsoil and are on adjacent flats and ridgetops. Muren soils have browner subsoil and are on knolls and ridgetops.

Typical pedon of Hoosierville silt loam, in a cultivated field; 1,550 feet west and 600 feet north of southeast corner sec. 6, T. 11 N., R. 6 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak medium granular structure; friable; many medium and fine roots; many fine iron and manganese oxide concretions; neutral; abrupt smooth boundary.

A2g—9 to 13 inches; grayish brown (10YR 5/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure; friable; common fine roots; common fine iron and manganese oxide concretions; strongly acid; clear wavy boundary.

B1g—13 to 18 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; common fine roots; many soft iron and manganese oxide accumulations; thick light gray (10YR 6/1) silt films on faces of peds; very strongly acid; clear wavy boundary.

B21tg—18 to 27 inches; gray (10YR 6/1) silty clay loam; many medium distinct yellowish brown (10YR 5/8)

mottles; weak medium prismatic structure parting to moderate medium subangular blocky and angular blocky; firm; few fine roots; thin and medium light gray (10YR 6/1) silt and clay films on faces of all peds; common soft iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B22tg—27 to 40 inches; gray (10YR 6/1) silty clay loam; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few fine roots; thin and medium gray (10YR 6/1) clay and silt films on faces of peds and linings of many voids; common soft iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B23t—40 to 60 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct gray (10YR 6/1) mottles; weak coarse prismatic structure; firm; thin to thick gray (10YR 6/1) clay films on faces of peds; common soft iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C—60 to 70 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct gray (10YR 5/1) mottles; massive; friable; medium acid.

The solum ranges from 45 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2.

The B2 horizon has hue of 10YR or 2.5Y and value of 5 or 6. The upper part of the B2 horizon has chroma of 1 or 2, and the lower part has chroma of 1 to 6. The B2 horizon is silt loam or silty clay loam. A B3 horizon is present in some pedons.

Iva series

The Iva series consists of deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slope ranges from 0 to 2 percent.

Iva soils are commonly near Ava, Cincinnati, and Muren soils. Ava and Cincinnati soils have a browner subsoil than Iva soils. Also, they have a fragipan, more sand and gravel in the lower part of the solum, and are in draws and on knolls. Muren soils have a browner subsoil and are on knolls or ridges.

Typical pedon of Iva silt loam, 0 to 2 percent slopes, in a cultivated field; 1,400 feet west and 250 feet south of northeast corner sec. 18, T. 13 N., R. 6 W.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 12 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium and thick platy structure parting to moderate fine granular; friable; many tubular pores; worm and root channels filled with grayish brown (10YR 5/2) silt loam; few light gray (10YR 7/2) silt coatings; neutral; clear wavy boundary.

B1—12 to 19 inches; yellowish brown (10YR 5/6) silt loam; many fine distinct light brownish gray (10YR 6/2) and many fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable; voids filled with grayish brown (10YR 5/2) silt loam; grayish brown (10YR 5/2) silt loam coatings on vertical faces of peds; strongly acid; clear wavy boundary.

B21tg—19 to 34 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; firm; thin grayish brown (10YR 5/2) clay films on faces of peds; grayish brown (10YR 5/2) silt coatings on some horizontal and most vertical faces of peds; voids filled with grayish brown (10YR 5/2) silt loam; black (10YR 2/1) and dark reddish brown (5YR 3/2) iron and manganese oxide concretions; strongly acid; gradual wavy boundary.

B22tg—34 to 40 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; thin grayish brown (10YR 5/2) clay films on faces of peds; grayish brown (10YR 5/2) silt coatings on some horizontal and most vertical faces of peds; black (10YR 2/1) and dark reddish brown (5YR 3/2) iron and manganese oxide concretions; strongly acid; gradual wavy boundary.

B3g—40 to 51 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; friable; black (10YR 2/1) and dark reddish brown (5YR 3/2) iron and manganese oxide concretions; strongly acid; gradual wavy boundary.

C—51 to 60 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; black (10YR 2/1) iron and manganese oxide concretions; medium acid; clear wavy boundary.

The solum ranges from 48 to 60 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2.

The B1 horizon is absent in some pedons that have a thick A2 horizon. The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2. It has distinct or prominent mottles of higher chroma. The B3 horizon mainly has hue of 10YR, value of 5 or 6, and chroma of 2. It is silt loam or silty clay loam and has distinct or prominent mottles of higher chroma.

Lobdell series

The Lobdell series consists of deep, moderately well drained, moderately permeable soils on bottom lands. These soils formed in alluvium that washed from loess-mantled uplands. Slope is 0 to 1 percent.

Lobdell soils are similar to Steff and Wilbur soils and are adjacent to Hickory and Shoals soils. Steff soils are more acid than Lobdell soils and have less sand. Wilbur soils have less sand. Hickory soils have more clay and are in draws and on breaks on uplands. Shoals soils have a grayer substratum. All of these soils except Hickory soils are on bottom lands.

Typical pedon of Lobdell loam, occasionally flooded, in a cultivated field; 75 feet west and 750 feet south of northeast corner sec. 2, T. 13 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

B21—8 to 14 inches; dark grayish brown (10YR 4/2) loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

B22—14 to 18 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

B23—18 to 31 inches; brown (10YR 4/3) loam; many fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; neutral; clear wavy boundary.

C1—31 to 41 inches; brown (10YR 4/3) silt loam; many fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; massive; friable; few black (10YR 2/1) iron and manganese oxide concretions; neutral; clear wavy boundary.

C2—41 to 52 inches; brown (10YR 4/3) loam; many fine distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; massive; friable; neutral; gradual wavy boundary.

C3g—52 to 60 inches; grayish brown (10YR 5/2) stratified sandy loam, silt loam, loam, and sand; many medium distinct strong brown (7.5YR 5/6) mottles; friable; few black (10YR 2/1) iron and manganese oxide accumulations; neutral.

The soil is slightly acid or neutral in the upper 30 inches and neutral below this depth.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has thin horizons with the same hue and value but with chroma of 2. Few or common mottles with hue of 10YR, value of 5 or 6, and chroma of 2 are in the upper part of the B2 horizon of some pedons. Common or many mottles with hue of 10YR, value of 5 or 6, and chroma of 2 are in the lower part of the B2 horizon. The B2 horizon is loam or silt loam.

The C horizon is silt loam, loam, or fine sandy loam.

Lyles series

The Lyles series consists of deep, very poorly drained, moderately permeable soils in upland depressions. These soils formed in sandy and loamy, stratified outwash. Slope is 0 to 1 percent.

Lyles soils are adjacent to Alvin, Bloomfield, Ayrshire, and Princeton soils. Alvin and Bloomfield soils have a browner subsoil than Lyles soils and more sand in the solum. Ayrshire soils are browner in the upper part of the solum and do not have a mollic epipedon. Princeton soils are browner throughout the solum. Alvin, Bloomfield, and Princeton soils are on higher positions in the landscape and do not have a mollic epipedon. Ayrshire soils are on flats and in swales.

Typical pedon of Lyles fine sandy loam, in a cultivated field; 1,500 feet east and 550 feet south of northwest corner sec. 36, T. 10 N., R. 7 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—8 to 17 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; friable; common fine pores; neutral; clear wavy boundary.

B21g—17 to 27 inches; dark gray (10YR 4/1) fine sandy loam; few fine distinct yellowish brown (10YR 5/6) and olive brown (2.5Y 4/4) mottles; weak fine and medium subangular blocky structure; friable; common fine pores; very dark gray (10YR 3/1) organic coatings on faces of peds; very dark gray (10YR 3/1) fine sandy loam fillings in cracks and crayfish holes; neutral; clear wavy boundary.

B22g—27 to 40 inches; gray (10YR 5/1) fine sandy loam; common fine distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; few fine pores; thin strata of sandy clay loam; thin discontinuous dark gray (10YR 4/1) organic coatings on faces of peds and fillings in pores and cracks; neutral; gradual wavy boundary.

B23g—40 to 55 inches; gray (10YR 5/1) fine sandy loam; common fine distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; thin strata of sandy clay loam; thin discontinuous dark gray (10YR 4/1) organic coatings on vertical faces of peds; few very dark gray (10YR 3/1) iron and manganese oxide stains; neutral; clear irregular boundary.

B3—55 to 60 inches; light brownish gray (10YR 6/2) stratified loamy fine sand and sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak

coarse prismatic structure; very friable; neutral; gradual irregular boundary.

Cg—60 to 70 inches; light brownish gray (10YR 6/2) fine sand; few fine distinct yellowish brown (10YR 5/4) mottles; single grain; loose; neutral.

The solum ranges from 45 to 60 inches in thickness and is neutral or mildly alkaline.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is 12 to 18 inches thick.

The B2g horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1. It has distinct mottles. It is fine sandy loam, sandy loam, or loam and contains thin strata of sandy clay loam in some pedons.

Montgomery Variant

The Montgomery Variant consists of deep, very poorly drained, slowly permeable and very slowly permeable soils in depressions of lake plains and low terraces. These soils formed in silty sediment. Slope is 0 to 1 percent.

Montgomery Variant soils are commonly near Evansville and Zipp soils. Evansville and Zipp soils do not have a mollic epipedon. Evansville soils have less clay in the solum. All of these soils are on lake plains or low terraces.

Typical pedon of Montgomery Variant silty clay loam, in a cultivated field; 1,100 feet east and 2,100 feet south of northwest corner sec. 3, T. 10 N., R. 6 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common fine roots; neutral; abrupt wavy boundary.

A12—7 to 11 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; common fine roots; slightly acid; abrupt wavy boundary.

B21g—11 to 21 inches; gray (10YR 5/1) silty clay loam; few fine distinct brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; firm; thin discontinuous dark gray (10YR 4/1) films and pressure faces on peds; vertical cracks between prisms filled with very dark gray (10YR 3/1) silty clay loam and tubular tongues of gray (10YR 5/1) silty clay loam; very strongly acid; gradual wavy boundary.

B22g—21 to 36 inches; gray (10YR 5/1) silty clay loam; common fine distinct brown (7.5YR 4/4) mottles; weak coarse prismatic structure parting to moderate fine angular blocky; very firm; thin, discontinuous dark gray (10YR 4/1) films and pressure faces on peds; tubular tongues and vertical crack fillings of gray (10YR 5/1) silty clay loam; very strongly acid; gradual wavy boundary.

B23g—36 to 50 inches; gray (10YR 6/1) silty clay loam; common fine distinct yellowish red (5YR 5/8) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak coarse angular blocky; firm; few thin tubular tongues and vertical crack fillings of gray (10YR 5/1) silty clay loam; soft accumulations of dark reddish brown (5YR 3/4) iron and manganese oxide; very strongly acid; gradual wavy boundary.

B3g—50 to 80 inches; gray (10YR 6/1) silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure grading to weak very coarse prismatic in lower part; firm; few thin tongues and vertical crack fillings of gray (10YR 5/1) silty clay loam; many accumulations of dark reddish brown (5YR 3/4) iron and manganese oxide; very strongly acid.

The solum ranges from 60 to 90 inches in thickness. It is strongly acid or very strongly acid in the upper part of the B horizon and very strongly acid to medium acid in the lower part.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1. It is 10 to 14 inches thick.

The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or has neutral colors and is distinctly mottled.

Muren series

The Muren series consists of deep, moderately well drained soils on uplands. These soils formed in loess. Permeability is moderately slow. Slope ranges from 0 to 6 percent.

These soils have lower base saturation than is definitive for the Muren series. This difference does not alter the usefulness or behavior of these soils.

Muren soils are similar to Ava soils and adjacent to Cincinnati, Hickory, and Iva soils. Ava and Cincinnati soils have a fragipan, have more sand in the lower part of the solum than Muren soils, and are on knolls and on breaks. Cincinnati soils have a browner subsoil. Hickory soils have more sand throughout the solum, have a browner subsoil, and are in draws and on breaks. Iva soils have a grayer subsoil and are on flats.

Typical pedon of Muren silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,350 feet east and 225 feet north of southwest corner sec. 2, T. 12 N., R. 7 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.

B1—9 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; pale brown (10YR 6/3) silt coatings on faces of peds; strongly acid; clear wavy boundary.

B21t—15 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct pale brown (10YR 6/3)

and olive brown (2.5Y 4/4) mottles; moderate fine and medium subangular blocky structure; firm; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; pale brown (10YR 6/3) silt coatings on faces of peds and in cracks; very strongly acid; clear wavy boundary.

B22t—23 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; common fine distinct light brownish gray (10YR 6/2) and olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B23t—27 to 36 inches; yellowish brown (10YR 5/6) silty clay loam; many fine distinct light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; grayish brown (10YR 5/2) silt coatings on faces of peds and fillings in vertical cracks; few black (10YR 2/1) iron and manganese oxide concretions; very strongly acid; clear wavy boundary.

B24t—36 to 54 inches; yellowish brown (10YR 5/4) silt loam; many fine distinct light brownish gray (10YR 6/2) mottles; weak medium and coarse subangular blocky structure; friable; common patchy distinct brown (10YR 5/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct light brownish gray (10YR 6/2) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; few black (10YR 2/1) iron and manganese oxide concretions; very strongly acid.

The solum ranges from 45 to 60 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Plowing has incorporated fragments of the A2 horizon or B1 horizon into the plow layer in some eroded areas. The A2 horizon where present has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B1 horizon is absent in some pedons. Where present, it has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It has distinct mottles. A silt loam B3 horizon is present in some pedons.

Newark series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. These soils formed in silty alluvium that washed from loess-mantled uplands. Slope is 0 to 1 percent.

Newark soils are similar to Shoals and Stendal soils and commonly near Wilbur soils. Shoals soils contain more sand than Newark soils. Stendal soils are more acid. Wilbur soils have a browner substratum. All of these soils are on bottom lands.

Typical pedon of Newark silt loam, frequently flooded, in a cultivated field; 150 feet east and 100 feet north of southwest corner sec. 14. T. 10 N., R. 7 W.

Ap—0 to 9 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

B21—9 to 19 inches; pale brown (10YR 6/3) silt loam; many medium faint light brownish gray (10YR 6/2) and many fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; many fine pores; patchy brown (10YR 5/3) silt loam films on faces of peds; neutral; gradual wavy boundary.

B22g—19 to 38 inches; grayish brown (10YR 5/2) silt loam; many fine distinct yellowish brown (10YR 5/6) and common fine distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; many fine pores; brown (10YR 5/3) silt loam films on faces of peds; neutral; gradual wavy boundary.

C1—38 to 48 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct yellowish brown (10YR 5/6) and common fine distinct brown (7.5YR 4/4) mottles; massive; friable; few fine pores; many dark brown (7.5YR 3/2) iron and manganese oxide accumulations; neutral; gradual wavy boundary.

C2—48 to 60 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct yellowish brown (10YR 5/6) and common fine distinct brown (7.5YR 4/4) mottles; massive; friable; many dark brown (7.5YR 3/2) iron and manganese oxide accumulations; neutral.

The solum is slightly acid or neutral throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It has distinct mottles.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 2. It has distinct mottles. The C horizon below a depth of 40 inches is silt loam or stratified silt loam, silty clay loam, loam, and fine sandy loam.

Nolin series

The Nolin series consists of deep, well drained, moderately permeable soils on broad bottom lands. These soils formed in silty alluvium washed from loess-covered uplands. Slope is 0 to 1 percent.

Nolin soils are similar and adjacent to Chagrin soils. Chagrin soils have more sand in the solum than Nolin soils.

Typical pedon of Nolin silt loam, rarely flooded, in a cultivated field; 2,300 feet east and 200 feet south of northwest corner sec. 32, T. 12 N., R. 5 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

A12—7 to 12 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; few fine roots; continuous dark brown (10YR 3/3) silt loam coatings on faces of peds; neutral; gradual wavy boundary.

B21—12 to 28 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; common fine pores; continuous dark brown (10YR 4/3) silt loam coatings on faces of peds; neutral; gradual wavy boundary.

B22—28 to 43 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common fine pores; continuous dark yellowish brown (10YR 4/4) silt loam coatings on faces of peds; neutral; gradual wavy boundary.

C1—43 to 55 inches; yellowish brown (10YR 5/4) stratified loam and silt loam; massive; friable; neutral; gradual wavy boundary.

C2—55 to 60 inches; yellowish brown (10YR 5/4) stratified loam, fine sandy loam, and loamy fine sand; massive; friable; neutral.

The solum ranges from 40 to 60 inches in thickness. It is slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or silty clay loam.

The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. This horizon is silt loam or silty clay loam and has angular or subangular blocky structure.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is commonly stratified silt loam, loam, or fine sandy loam and has strata of loamy fine sand or fine sand below a depth of 50 inches.

Parke series

The Parke series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and the underlying glacial outwash. Slope ranges from 12 to 18 percent.

These soils have a slightly lower base status than is definitive for the Parke series. This difference does not alter the usefulness or behavior of these soils.

Parke soils are similar to Pike soils and commonly near Chetwynd and Pike soils. Chetwynd soils are on breaks to bottom lands and in draws and contain more sand and less silt throughout the solum than Parke soils. Pike soils are on knolls and have more silt and less sand to a greater depth in the subsoil.

Typical pedon of Parke silt loam, 12 to 18 percent slopes, eroded, in a cultivated field; 600 feet west and 1,200 feet north of southeast corner sec. 22, T. 12 N., R. 5 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B21t—6 to 14 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark brown (7.5YR 4/4) clay films on most faces of peds; very strongly acid; gradual wavy boundary.

B22t—14 to 22 inches; strong brown (7.5YR 5/6) silt loam; moderate coarse subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 4/4) clay films on most faces of peds; very strongly acid; clear wavy boundary.

B23t—22 to 29 inches; strong brown (7.5YR 5/6) silt loam; weak coarse subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on most faces of peds; strongly acid; clear wavy boundary.

IIB24t—29 to 40 inches; brown (7.5YR 5/4) loam; weak coarse subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on some faces of peds; very strongly acid; clear wavy boundary.

IIB25t—40 to 55 inches; reddish brown (5YR 4/4) sandy clay loam; weak coarse subangular blocky structure; firm; thin discontinuous yellowish red (5YR 4/6) clay films on most faces of peds; 3 percent fine gravel; strongly acid; gradual wavy boundary.

IIB26t—55 to 80 inches; reddish brown (5YR 4/4) sandy loam; weak very coarse subangular blocky structure; friable; thin discontinuous yellowish red (5YR 4/6) clay films on some faces of peds; 2 to 5 millimeters thick vertical light yellowish brown (10YR 6/4) streaks and rounded masses of sand; strongly acid; gradual wavy boundary.

Loess in the upper part of the solum ranges from 24 to 40 inches in thickness. The B2t and IIB2t horizons are strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. A silt loam A2 horizon is present in pedons that are not eroded.

The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The upper part of the IIB2t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is loam or sandy loam. The lower part of the IIB2t horizon has hue of 5YR, value of 4 or 5, and chroma of 3 to 8. It is sandy loam or sandy clay loam.

The depth to loose stratified sand and gravel in the C horizon is more than 5 feet.

Peoga series

The Peoga series consists of deep, poorly drained, slowly permeable soils on broad, glacial lake plains and

low alluvial terraces. These soils formed in silty sediment. Slope is 0 to 1 percent.

Peoga soils are similar to Hoosierville and Vigo soils and commonly near Bonnie and Stendal soils. Hoosierville soils have less clay in the lower part of the solum than Peoga soils. Vigo soils have a thicker A2 horizon, and the subsoil is more acid. Hoosierville and Vigo soils are on higher positions. Bonnie and Stendal soils are on bottom lands and have less clay in the subsoil and substratum.

Typical pedon of Peoga silt loam, in a cultivated field; 1,400 feet west and 150 feet north of southeast corner sec. 36, T. 11 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A2g—8 to 11 inches; grayish brown (10YR 5/2) silt loam; common fine distinct gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; weak thick platy structure; friable; common fine roots; numerous fine pores; dark grayish brown (10YR 4/2) silt loam fillings in worm and root channels; slightly acid; clear irregular boundary.

B1g—11 to 23 inches; gray (10YR 6/1) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; numerous fine pores; light gray (10YR 6/1) silt flows between prisms and as tubular tongues; few dark reddish brown (5YR 3/3) iron and manganese oxide accumulations; strongly acid; clear irregular boundary.

B21tg—23 to 35 inches; gray (10YR 6/1) silty clay loam; common fine distinct strong brown (7.5YR 5/6) and few fine prominent dark red (2.5YR 3/6) mottles; moderate medium and coarse prismatic structure; firm; thin gray (10YR 5/1) clay films on faces of most peds; light gray (10YR 6/1) silt flows between prisms and as tubular tongues; few black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B22tg—35 to 48 inches; gray (10YR 5/1) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; medium and thick dark gray (10YR 4/1) clay films on most faces of peds; gray (10YR 6/1) silt flows between prisms and as tongues; few black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B23tg—48 to 60 inches; gray (10YR 6/1) silty clay loam; many medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; thick dark gray (N 4/0) clay films on most faces of prisms; dark gray (N 4/0) silt flows; numerous black (10YR 2/1) and dark reddish brown (5YR 3/4) iron and manganese oxide accumulations; strongly acid; clear irregular boundary.

Cg—60 to 70 inches; mottled gray (10YR 5/1) and strong brown (7.5YR 5/6) stratified silty clay loam and silt loam; massive; friable; few gray (10YR 5/1) silt flows and tongues; slightly acid.

The solum ranges from 48 to 65 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. The A2g horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2.

The B1g horizon is absent in some pedons. Where this horizon is present, it has hue of 10YR, value of 5 to 7, and chroma of 1 and has distinct higher chroma mottles. It is silt loam or silty clay loam. The B2tg horizon has hue of 10YR, 2.5Y or 5Y, value of 5 to 7, and chroma of 1 and has distinct or prominent higher chroma mottles. The B2tg horizon is silt loam or silty clay loam. It is strongly acid or very strongly acid in the upper part and strongly acid or medium acid in the lower part.

The Cg horizon is silt loam or silty clay loam. In some pedons, it has thin strata of clay loam, loam, or fine sandy loam. It is medium acid or slightly acid.

Petrolia series

The Petrolia series consists of deep, poorly drained soils in broad bottom lands. These soils formed in silty alluvium. Permeability is moderately slow. Slope is 0 to 1 percent.

Petrolia soils are similar to Evansville soils and are commonly adjacent to Newark and Zipp soils. Evansville soils do not flood so frequently as Petrolia soils and are on low terraces. Newark soils have less clay, a browner subsoil, and are on bottom lands. Zipp soils have more clay and are on lake plains and bottom lands.

Typical pedon of Petrolia silty clay loam, frequently flooded, in a cultivated field; 150 feet west and 1,170 feet south of northeast corner sec. 25, T. 11 N., R. 6 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B21g—7 to 14 inches; gray (10YR 5/1) silty clay loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine and medium subangular blocky structure; firm; few medium pores; neutral; gradual wavy boundary.

B22g—14 to 24 inches; gray (10YR 5/1) silty clay loam; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine pores; thin patchy grayish brown (10YR 5/2) films on faces of some peds; neutral; gradual wavy boundary.

B23g—24 to 40 inches; gray (10YR 6/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; weak

medium prismatic structure parting to weak medium subangular blocky; firm; few fine pores; thin patchy grayish brown (10YR 5/2) films on faces of peds; common fine black (10YR 2/1) iron and manganese oxide concretions; neutral; gradual wavy boundary.

B3g—40 to 55 inches; gray (10YR 6/1) silty clay loam; common fine distinct brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure; firm; many coarse black (10YR 2/1) iron and manganese oxide concretions; slightly acid; clear wavy boundary.

Cg—55 to 60 inches; gray (10YR 6/1) stratified silt loam and silty clay loam; common fine distinct brown (7.5YR 4/4) and many fine distinct strong brown (7.5YR 5/8) mottles; massive; firm; few fine black (10YR 2/1) iron and manganese oxide concretions; slightly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2.

The B and C horizons have hue of 10YR, value of 5 or 6, and chroma of 1 or have neutral matrix color. Distinct or prominent mottles of higher chroma are present. These horizons are slightly acid or neutral.

Pike series

The Pike series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and the underlying glacial outwash. Slope ranges from 0 to 12 percent.

Pike soils are similar to Parke soils and commonly near Chetwynd and Parke soils. Chetwynd soils are on breaks to bottom lands and in draws and contain more sand and less silt throughout the solum than Pike soils. Parke soils are on ridges and knolls and contain more sand and less silt in the lower part of the solum.

Typical pedon of Pike silt loam, 2 to 6 percent slopes, eroded, in a cultivated field; 1,000 feet east and 1,250 feet south of northwest corner sec. 16, T. 13 N., R. 7 W.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; weak medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—9 to 17 inches; brown (7.5YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/4) clay films on most faces of peds; strongly acid; gradual wavy boundary.

B22t—17 to 33 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; medium continuous dark brown (7.5YR 4/4) clay films on most faces of peds; strongly acid; gradual wavy boundary.

B23t—33 to 50 inches; brown (7.5YR 5/4) silt loam; weak medium and coarse subangular blocky structure; friable; thin continuous dark brown (7.5YR 4/4) clay films on most faces of peds; strongly acid; clear wavy boundary.

IIB24t—50 to 64 inches; brown (7.5YR 4/4) loam; weak coarse subangular blocky structure; friable; common medium tubular pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds and lining pores; few small fragments of yellowish red (5YR 4/6) sandy clay loam in lower part; strongly acid; clear wavy boundary.

IIB25t—64 to 80 inches; yellowish red (5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; common fine tubular pores; patchy reddish brown (5YR 4/4) clay films on faces of peds and lining pores; light yellowish brown (10YR 6/4) silt and fine sand streaks and coatings between prisms; strongly acid.

The solum ranges from 65 to 96 inches in thickness. The part of the solum formed in loess is 42 to 60 inches thick.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. A silt loam A2 horizon is present in pedons that are not eroded.

Some pedons have a silt loam B1 horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is silt loam or silty clay loam. The upper part of the IIB2t horizon is silt loam or loam and has hue of 7.5YR, value of 4 or 5, and chroma of 4 or 6. The lower part of the IIB2t horizon has hue of 5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy clay loam or loam and becomes more sandy as depth increases.

Princeton series

The Princeton series consists of deep, well drained soils on uplands. These soils formed in wind-deposited sand and silt. Permeability is moderate in the solum and moderately rapid in the underlying material. Slope ranges from 2 to 12 percent.

These soils have lower base status and the substratum is more acid than is definitive for the Princeton series. These differences do not alter the usefulness or behavior of these soils.

Princeton soils are similar to Alvin soils and adjacent to Alvin, Bloomfield, Ayrshire, and Lyles soils. Alvin and Bloomfield soils are sandier than Princeton soils and are on knolls. Ayrshire soils have a grayer subsoil and are on flats and in drainageways. Lyles soils have a thicker, darker surface layer, a grayer subsoil, and are in depressions.

Typical pedon of Princeton fine sandy loam, 2 to 6 percent slopes, in a cultivated field; 625 feet west and 1,200 feet north of the center of sec. 25, T. 10 N, R. 7 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, light yellowish brown (10YR 6/4) dry; weak

fine granular structure; very friable; medium acid; abrupt smooth boundary.

B1t—8 to 15 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; thin patchy dark brown (10YR 4/3) clay films on faces of many peds; fillings in worm and root channels of dark grayish brown (10YR 4/2) loam; medium acid; clear wavy boundary.

B21t—15 to 24 inches; brown (7.5YR 5/4) loam; moderate fine and medium subangular blocky structure; friable; thin continuous dark brown (7.5YR 4/4) clay films on faces of most peds; strongly acid; clear wavy boundary.

B22t—24 to 37 inches; dark brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; thin continuous reddish brown (5YR 4/4) clay films on faces of most peds; very strongly acid; gradual wavy boundary.

B3—37 to 60 inches; dark brown (7.5YR 4/4) banded loamy sand and sandy loam; weak coarse subangular blocky structure; very friable; thin patchy reddish brown (5YR 4/4) clay films on faces of some peds; strongly acid; gradual wavy boundary.

C—60 to 70 inches; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid.

The solum ranges from 45 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. A fine sandy loam A2 horizon is present in some pedons.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loam, sandy clay loam, or sandy loam.

Shoals series

The Shoals series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. These soils formed in silty and loamy alluvium washed from loess-mantled glacial till on uplands. Slope is 0 to 1 percent.

Shoals soils are similar to Newark and Stendal soils and commonly near Hickory and Lobdell soils. Newark and Stendal soils have less sand and more silt than Shoals soils, and Stendal soils are more acid. Hickory soils have a browner subsoil and more clay. Lobdell soils have a browner substratum. Hickory soils are on adjacent side slopes of draws and breaks to bottom lands, and the other soils are on bottom lands.

Typical pedon of Shoals silt loam, frequently flooded, in pasture; 1,450 feet south and 120 feet east of northwest corner sec. 11, T. 13 N., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

B21—6 to 14 inches; brown (10YR 5/3) silt loam; few fine distinct brown (7.5YR 4/4) and common fine faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; worm and root channels filled with dark grayish brown (10YR 4/2) silt loam; neutral; gradual wavy boundary.

B22—14 to 21 inches; grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few dark reddish brown (5YR 3/3) iron and manganese oxide concretions; neutral; gradual wavy boundary.

B23—21 to 27 inches; dark grayish brown (10YR 4/2) loam; common fine distinct yellowish brown (10YR 5/8) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; very dark grayish brown (10YR 3/2) iron and manganese oxide concretions; neutral; gradual wavy boundary.

B3—27 to 34 inches; grayish brown (10YR 5/2) loam; common fine distinct yellowish brown (10YR 5/6) and common fine prominent reddish brown (5YR 4/4) mottles; weak coarse subangular blocky structure; friable; very dark grayish brown (10YR 3/2) iron and manganese oxide concretions; neutral; gradual wavy boundary.

C—34 to 60 inches; grayish brown (10YR 5/2) stratified loam and sandy loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint gray (10YR 5/1) mottles; massive; friable; neutral.

The control section is neutral or slightly acid.

The Ap or A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and mainly chroma of 2, but chroma is 3 in places. The B horizon has distinct or prominent mottles and is silt loam or loam.

The C horizon is silt loam or loam and has thin sandy loam or fine sandy loam subhorizons in the lower part.

Steff series

The Steff series consists of deep, moderately well drained, moderately permeable soils on bottom lands. These soils formed in acid alluvium washed from loess-mantled uplands. Slope is 0 to 1 percent.

Steff soils are similar to Lobdell and Wilbur soils and adjacent to Bonnie and Stendal soils. Lobdell soils have more sand and are less acid than Steff soils. Wilbur soils have less clay and are less acid. Bonnie and Stendal soils have a grayer substratum. All of these soils are on bottom lands.

Typical pedon of Steff silt loam, occasionally flooded, in a cultivated field; 750 feet east and 1,350 feet south of northwest corner sec. 5, T. 11 N., R. 6 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B21—9 to 20 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; worm and root channels filled with brown (10YR 4/3) silt loam; slightly acid; clear wavy boundary.

B22—20 to 30 inches; yellowish brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; weak coarse subangular blocky structure; friable; few strong brown (7.5YR 5/6) soft iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C1—30 to 44 inches; light brownish gray (10YR 6/2) silt loam; many fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; few strong brown (7.5YR 5/8) soft iron and manganese oxide accumulations; very strongly acid; gradual wavy boundary.

C2—44 to 60 inches; light brownish gray (10YR 6/2) stratified silt loam, loam, and fine sandy loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint light gray (10YR 7/2) mottles; friable; numerous strong brown (7.5YR 5/8) soft iron and manganese oxide accumulations; very strongly acid.

The control section is dominantly strongly acid or very strongly acid.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has distinct mottles of lower chroma.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2. It has distinct mottles of higher chroma. In some pedons between depths of 40 and 60 inches, the C horizon is silt loam.

Stendal series

The Stendal series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. These soils formed in acid, silty alluvium washed from loess-mantled uplands. Slope is 0 to 1 percent.

Stendal soils are similar to Newark and Shoals soils and commonly near Bonnie and Steff soils. Newark soils are less acid and have less clay than Stendal soils. Shoals soils are less acid and have more sand. Bonnie soils have a grayer substratum. Steff soils have a browner substratum. All of these soils are on bottom lands.

Typical pedon of Stendal silt loam, frequently flooded, in a cultivated field; 1,300 feet east and 150 feet north of southwest corner sec. 23, T. 10 N., R. 7 W.

Ap—0 to 8 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few small masses of light brownish gray (10YR 6/2) silt loam; medium acid; abrupt smooth boundary.

B21g—8 to 15 inches; pale brown (10YR 6/3) silt loam; many fine distinct yellowish brown (10YR 5/8) and common fine faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; many fine pores; few small dark brown (7.5YR 4/4) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

B22g—15 to 30 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; friable; many fine pores; few 5 to 10 millimeters thick light gray (10YR 7/2) tongues of silt; common dark reddish brown (5YR 3/4) and few black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C1g—30 to 40 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few 5 to 10 millimeters thick light gray (10YR 7/2) tongues of silt; many black (10YR 2/1) and strong brown (7.5YR 5/8) iron and manganese oxide concretions and accumulations; strongly acid; gradual wavy boundary.

C2g—40 to 55 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) and many medium distinct dark brown (7.5YR 4/4) mottles; massive; friable; few 10 to 20 millimeters thick light gray (10YR 7/2) tongues of silt; many black (10YR 2/1) and dark brown (7.5YR 3/2) iron and manganese oxide accumulations; strongly acid; gradual wavy boundary.

C3g—55 to 60 inches; light brownish gray (10YR 6/2) stratified silt loam, loam, fine sandy loam, and silty clay loam; many fine distinct yellowish brown (10YR 5/6) and many medium distinct dark brown (7.5YR 4/4) mottles; massive; friable; few 10 to 20 millimeters thick light gray (10YR 7/1) tongues of silt; many black (10YR 2/1) and dark brown (7.5YR 3/2) iron and manganese oxide accumulations; medium acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 and C horizons have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 or 3. They have many distinct or prominent mottles of higher chroma. The C horizon below a depth of 40 inches is silt loam or stratified silt loam, loam, fine sandy loam, or silty clay loam.

The B2 horizon is strongly acid or very strongly acid, and the C horizon is strongly acid or medium acid.

Stonelick series

The Stonelick series consists of deep, well drained soils on bottom lands. These soils formed in loamy and sandy alluvium. Permeability is moderately rapid. Slope is 0 to 1 percent.

Because these soils are not calcareous, they are taxadjuncts to the Stonelick series. This difference does not alter the usefulness or behavior of this soil.

Stonelick soils are commonly near Chagrin and Wilbur soils. Chagrin and Wilbur soils are on bottom lands and contain more silt and less sand in the subsoil and substratum than Stonelick soils.

Typical pedon of Stonelick fine sandy loam, occasionally flooded, from an area of Chagrin-Stonelick complex, occasionally flooded, in a cultivated field; 150 feet south and 1,050 feet west of the center of sec. 33, T. 11 N., R. 6 W.

Ap—0 to 8 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

C1—8 to 22 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; many fine roots; many fine pores; neutral; clear wavy boundary.

C2—22 to 30 inches; yellowish brown (10YR 5/4) loamy fine sand; weak medium granular structure; very friable; neutral; clear wavy boundary.

C3—30 to 60 inches; yellowish brown (10YR 5/4) stratified fine sand and very fine sand; single grain; loose; bands of yellowish brown (10YR 5/4) fine sandy loam and loamy fine sand; massive; very friable; bands 1/2 inch to 2 inches thick that have a cumulative total of 6 inches; neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon has hue of 10YR or 7.5YR, value of 4 and 5, and chroma of 3 or 4. In most pedons, the lower boundary of fine sandy loam in the C horizon is at a depth of 18 to 24 inches.

Vigo series

The Vigo series consists of deep, poorly drained, very slowly permeable soils on uplands. These soils formed in loess and the underlying glacial till. Slope ranges from 0 to 2 percent.

Vigo soils are similar to Hoosierville and Peoga soils and are commonly near Ava and Cincinnati soils. Hoosierville soils have more silt and less sand in the lower part of the solum than Vigo soils and are on broad flats on uplands. Peoga soils have a thinner A2 horizon and are on lower positions in the landscape. Ava and Cincinnati soils have a browner subsoil, have a fragipan, and are on knolls and ridgetops and on breaks along drainageways.

Typical pedon of Vigo silt loam, 0 to 2 percent slopes, in a cultivated field; 900 feet east and 1,700 feet north of southwest corner sec. 27, T. 10 N., R. 6 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2g—8 to 25 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct light gray (10YR 7/1) and light yellowish brown (10YR 6/4) mottles; moderate medium platy structure in upper part and weak fine prismatic structure parting to weak thick platy in lower part; friable; slightly acid; abrupt irregular boundary.

B&A—25 to 34 inches; light gray (10YR 6/1) silty clay loam, B2tg part; common fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak fine and medium prismatic structure parting to moderate fine subangular blocky (prisms broader at base and tapering at the top); firm; thick light gray (10YR 6/1) silt coatings and clay films on faces of peds; tongues of light brownish gray (10YR 6/2) silt loam, A2 part, extend downward between prisms; friable; few fine roots; very strongly acid; clear irregular boundary.

B21tg—34 to 44 inches; light gray (10YR 6/1) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine angular blocky; very firm; gray (10YR 5/1) clay and silt films on faces of peds; silt flows and tongues 10 to 30 millimeters thick extend downward between prisms; tongues are thinner in the lower part; many dark reddish brown (5YR 3/4) iron and manganese oxide accumulations; very strongly acid; gradual irregular boundary.

B22tg—44 to 56 inches; light gray (10YR 6/1) silty clay loam; weak coarse prismatic structure; firm; thick gray (10YR 5/1) clay and silt films on faces of peds; light gray (10YR 7/1) silt fillings in crayfish holes; very strongly acid; clear wavy boundary.

IIB3t—56 to 80 inches; yellowish brown (10YR 5/6) clay loam; many fine distinct gray (10YR 6/1) mottles; weak very coarse prismatic structure; firm; light gray (10YR 6/1) clay films lining voids and patchy films on faces of prisms; gray (10YR 6/1) silt loam fillings in root channels and crayfish holes; few pebbles; strongly acid.

The loess ranges from 42 to 60 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. It has distinct mottles. The B&A horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. Silt coatings and silt flows or tongues of material from the A2 horizon are in the B&A horizon.

The B2tg horizon has hue of 10YR, value of 5 to 7, and chroma of 1. It has distinct mottles. The IIB3t horizon is clay loam or loam.

Wellston series

The Wellston series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and the underlying residuum from acid sandstone and shale bedrock. Slope ranges from 12 to 18 percent.

Wellston soils are commonly near Berks, Gilpin, and Hickory soils. Berks soils have more sandstone fragments and a thinner solum than Wellston soils. Gilpin soils have a thinner solum and less silt in the upper part. Hickory soils do not have sandstone fragments in the solum and are underlain with glacial till. All of these soils are in draws, on knolls, or on breaks to bottom lands.

Typical pedon of Wellston silt loam, 12 to 18 percent slopes, eroded, in pasture; 2,400 feet north and 400 feet east of southwest corner sec. 17, T. 11 N., R. 5 W.

Ap—0 to 3 inches; brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many fine roots; medium acid; abrupt wavy boundary.

B21t—3 to 8 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very fine subangular blocky structure; friable; many fine roots; thin patchy dark brown (7.5YR 4/4) clay films on faces of some peds; strongly acid; clear wavy boundary.

B22t—8 to 20 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; many fine roots; continuous medium dark brown (7.5YR 4/4) clay films on faces of most peds; few light gray (10YR 7/1) silt fillings in vertical cracks between peds; strongly acid; gradual wavy boundary.

B23t—20 to 27 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; few fine roots; continuous medium dark brown (7.5YR 4/4) clay films on faces of most peds; few pale brown (10YR 6/3) silt fillings in vertical cracks between peds; strongly acid; gradual wavy boundary.

B24t—27 to 34 inches; yellowish brown (10YR 5/4) silt loam; few fine prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable; few fine roots in cracks; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of some peds; strongly acid; gradual wavy boundary.

IIB3—34 to 51 inches; yellowish brown (10YR 5/4) channery loam; weak coarse subangular blocky structure; friable; thin patchy dark brown (7.5YR 4/4) clay films on vertical faces of some peds; sandstone fragments grading from 10 percent in upper part to 40 percent in lower part; strongly acid; abrupt irregular boundary.

Cr—51 to 60 inches; interbedded fractured sandstone and shale bedrock; cracks filled with yellowish brown (10YR 5/4) loam; massive; strongly acid.

Fractured bedrock is at a depth of 45 to 70 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. The A1 horizon has hue of 10YR, value of 3 to 4, and chroma of 1 or 2.

A B1 horizon is present in some pedons. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. It is silt loam or silty clay loam. The sandstone fragments range from 0 to 10 percent in the B2t horizon and from 15 to 40 percent in the IIB3 horizon.

In some pedons a IIC horizon is present. It is loam or sandy loam containing 20 to 60 percent coarse fragments. The IICr horizon is soft shale in some pedons. The fractured bedrock contains from 2 to 15 percent loam or sandy loam fillings in cracks.

Wilbur series

The Wilbur series consists of deep, moderately well drained, moderately permeable soils on bottom lands. These soils formed in silty alluvium washed from loess covered uplands. Slope is 0 to 1 percent.

These soils contain somewhat more clay in the control section than is definitive for the Wilbur series. This difference does not alter the usefulness or behavior of these soils.

Wilbur soils are similar to Chagrin, Lobdell, and Steff soils and near Newark soils. Chagrin soils have less silt than Wilbur soils and are well drained. Lobdell soils have more sand and clay. Newark soils have more clay and are somewhat poorly drained. Steff soils have more clay and are more acid. All of these soils are on bottom lands.

Typical pedon of Wilbur silt loam, occasionally flooded, in a cultivated field; 400 feet west and 1,100 feet south of northeast corner sec. 17, T. 10 N., R. 7 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B21—8 to 12 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure; friable; common fine pores; neutral; clear wavy boundary.

B22—12 to 18 inches; brown (10YR 5/3) silt loam; common fine distinct dark brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; friable; common fine pores; neutral; clear wavy boundary.

C1—18 to 27 inches; brown (10YR 5/3) silt loam; common fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; neutral; gradual wavy boundary.

C2—27 to 45 inches; brown (10YR 5/3) silt loam; many fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; neutral; gradual wavy boundary.

C3—45 to 60 inches; brown (10YR 5/3) silt loam; many fine faint grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; many dark reddish brown (5YR 3/4) iron and manganese oxide accumulations; neutral.

The soil is slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has mottles of low chroma.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It has common or many mottles of low chroma. In some pedons below a depth of 40 inches the C horizon is loam or fine sandy loam.

Zipp series

The Zipp series consists of deep, very poorly drained, very slowly permeable soils on lake plains and in swales or depressions on bottom lands. These soils formed in fine textured sediment. Slope is 0 to 1 percent.

Zipp soils are adjacent to Evansville and Montgomery Variant soils. Evansville soils have a lower clay content in the solum than Zipp soils, and Montgomery Variant soils have a thicker, darker surface layer.

Typical pedon of Zipp silty clay, frequently flooded, in a cultivated field; 600 feet east and 1,300 feet north of southwest corner sec. 22, T. 10 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay; moderate fine granular structure; firm; neutral; abrupt smooth boundary.

B21g—8 to 27 inches; gray (10YR 5/1) silty clay; common fine distinct strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; discontinuous gray (10YR 5/1) films on pressure faces and on faces of peds; few dark gray (10YR 4/1) organic films in vertical cracks; few black (10YR 2/1) iron and manganese oxide concretions; neutral; gradual wavy boundary.

B22g—27 to 45 inches; gray (10YR 5/1) silty clay; many fine distinct strong brown (7.5YR 5/8) and few fine distinct reddish brown (5YR 4/4) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; very firm; thin discontinuous gray (10YR 5/1) films on pressure faces and on faces of peds; few black (10YR 2/1) iron and manganese oxide concretions; neutral; clear wavy boundary.

C—45 to 60 inches; gray (10YR 5/1) silty clay; many fine distinct yellowish brown (10YR 5/6) and common fine distinct light olive brown (2.5Y 5/4) mottles; massive; very firm; few dark gray (10YR 4/1) organic films in vertical cracks; neutral.

The solum ranges from 36 to 48 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2. It is silty clay loam or silty clay.

A B1g horizon is present in some pedons. The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1. It has distinct mottles of higher chroma. Neutral colors with value of 4 to 6 are in some pedons.

The C horizon has strata of silty clay loam in some pedons.

formation of the soils

In this section, the major factors of soil formation and their degree of importance in the formation of the soils in Clay County are discussed.

factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rock and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

Parent material is the unconsolidated mass from which a soil is formed. The parent material in which the soils of Clay County formed consists of glacial till or outwash, lacustrine deposits or lakebed materials, and windblown sand and silt. Also, in a few areas residuum from sandstone and shale is covered by a thin mantle of glacial till (*14*). Recently deposited alluvium occurs along the rivers and streams.

As the glacial ice sheet receded from the uplands, a mantle of glacial till was exposed. Glacial till, which consists of a mixture of stones, sand, silt, and clay, has been deposited over the material weathered from bedrock or over drift from an earlier glacial age. An example of the soils that formed in this material is the Hickory soils. The melting ice produced a large volume of water that carried large amounts of sand and gravel. Sand and gravel were deposited in stratified layers known as glacial outwash. The Chetwynd soils formed in material weathered from outwash and a thin mantle of windblown silt. Till and outwash are known collectively as glacial drift.

Glacial till on the ridges and slopes generally ranges from a few feet to many feet in thickness. In valleys the till extends to a depth of 50 feet or more in places. Sandy and gravelly outwash deposits were left along pre-glacial stream valleys and in knolls on uplands.

As the glacial ice receded, lacustrine materials were deposited from still or ponded glacial melt water. In these temporary glacial lakes, as typified by the broad flat area south of Cory, melt water and local runoff were ponded, and fine materials of clay and silt size settled out. Examples of soils that formed in glacial lake deposits are Montgomery Variant soils.

A layer of loess has been deposited over the upland area of the county. This mantle of mostly silt-size material ranges from a few inches to 7 feet or more in thickness. In steeper areas, most of the loess was washed away. It remained on nearly level to moderately sloping areas, however, and is the material in which many of the present soils formed. Examples of soils that formed in more than 5 feet of loess are the Iva and Muren soils. The loess mantle is generally thicker in the northern and western parts of the county and thinner in the southern and eastern parts. Examples of soils that formed in loess and the underlying glacial till are Cincinnati, Ava, and Vigo soils.

Silt and sand material was carried by the wind and deposited as dunes on the uplands adjacent to the eastern side of the Eel River flood plain. This material was first deposited in the valley by glacial melt water. These deposits range from a few feet to 20 feet or more in thickness. The Alvin and Bloomfield soils formed in this material.

In a few areas along the sides of deep valleys and areas near Poland and Bowling Green, the soils formed in a thin mantle of glacial till and the underlying residuum from sandstone and shale bedrock. The Cincinnati Variant soils formed in this material.

Alluvium is deposited by floodwater of present streams. This material ranges in texture, depending on the speed of the water from which it was deposited. The Chagrin and Stendal soils formed in alluvium.

plant and animal life

Before Clay County was settled, the native vegetation was the most important organism that affected soil formation. Plants, bacteria, fungi, earthworms, burrowing animals, and the activities of man all contributed to the formation of the soil. The chief contribution of plants and animal life is the addition of organic matter and nitrogen to the soil. Organic matter is produced by plants. Plants absorb nutrients from the lower part of the soil, and when they die and decay some of these nutrients are left on or near the surface. Bacteria and fungi cause plant and animal remains to decompose into organic matter. Small burrowing animals and earthworms mix the organic matter into the soil.

The native vegetation in Clay County consisted mostly of hardwood, deciduous trees. The species of trees that were dominant depended mostly on natural soil drainage. The common trees were tulip-poplar, oak, hickory, elm, maple, and ash. A small amount of organic matter from decayed leaves and twigs is mixed throughout the topmost 1 or 2 inches of the soil. Examples of soils that formed mainly under hardwood trees are Cincinnati and Iva soils.

In small areas, the native vegetation consists of swamp grasses, sedges, and water-tolerant trees. The soils in these areas were covered with water much of the time, and as the organic material fell into the water, it decayed slowly and some of it accumulated. Montgomery Variant soils formed in these areas.

Man has greatly changed the soils since he cleared the forests. Sloping areas are more susceptible to erosion when the natural cover is removed and the soil is cultivated. In severely eroded areas, the organic matter content is lower and the natural, friable, surface layer is replaced by a hard, cloddy layer. In places, soil blowing has removed much of the surface layer from sandy soils. Man has also drained the wet soils and improved their aeration which causes more rapid oxidation of organic matter. Alluvium that washed from eroding uplands has been deposited on bottom lands at an accelerated rate. In places such as strip mines, man's activities have greatly changed the soil.

climate

The climate of Clay County is mid-continental and is characterized by a wide range of temperature.

Rainfall is moderately heavy and averages 38 inches annually. It is well distributed throughout the year but is slightly greater in spring and summer than in fall and winter. The large amount of rainfall has leached plant nutrients from the surface layer and has prevented the accumulation of calcium carbonate.

The climate is so nearly uniform throughout the county that differences among the soils cannot be explained on the basis of differences in climate alone. Climatic forces act upon rocks to form the parent materials in which soils are formed, but many of the important soil characteristics would not develop except for the activity of plant and animal life. In Clay County, the climate is such that leaching of the soil is greater than replacement. Most of the soils are strongly weathered and leached and are acid and low in fertility. For more detailed information on the climate of this county, see the section "General nature of the county."

relief

The relief of Clay County ranges from nearly level on bottom lands, terraces, and upland flats to very steep on breaks along draws. Most of the county has been dissected by streams.

Variations in relief have influenced the formation of the soils by affecting drainage, runoff, and erosion. Soils formed in the same type of parent material in steep areas are less strongly developed than those in nearly level or sloping areas. Runoff and, as a result, erosion are greater on steeper areas. Also, when runoff is greater, less water is available for plant growth and for leaching of soluble materials deeper into the soil profile.

Because of the variations in relief, several different soils have formed in the same kind of parent material. A good example of this is the Vigo and Cincinnati soils that formed in loess and the underlying glacial till. The Vigo soils are nearly level, poorly drained, and have a gray, mottled subsoil. The Cincinnati soils are moderately sloping, well drained, and have a brownish subsoil.

time

Time, usually a long time, is required for distinct horizons to form in a soil from parent material. Some soils mature more slowly than others because of differences in parent material, relief, and climate. A mature soil is one that has well developed A and B horizons that were produced by the natural processes of soil formation. A young soil, or an immature soil, has little or no horizon differentiation. For example, soils that formed in alluvium, such as Chagrin and Bonnie soils, are immature because the parent materials are young and new materials are deposited periodically.

Steep soils are also likely to be immature because erosion removes the soil material nearly as fast as it accumulates; also runoff is greater and less water infiltrates the soil. Zipp soils that formed in glacial lake deposits of Wisconsin age are immature soils that are not fully developed.

The soils that developed in glacial drift or old lacustrine materials with a thin layer of loess, such as Vigo and Cincinnati soils, have well developed profiles and are considered to be mature, or nearly so.

processes of soil formation

Several processes have been involved in the formation of the soils of Clay County. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all of the soils of this county. The organic matter content of some soils is low, but that of others is high. Generally, soils that have the most organic matter, such as the Montgomery Variant soils, have a thick dark surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils of this county. Leaching is generally believed to precede the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by acid reaction. Leaching of wet soils is slow because of a high water table or because water moves slowly through such soils.

Clay accumulates in pores and other voids, and films form on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. For example, translocated silicate clays have accumulated in the B2t horizon of Pike soils in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils of this county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

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glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainage, subsurface. Removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow

over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to

permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in

a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Underlying material. (see substratum).

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1955-76 at Terre Haute]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	35.3	17.7	26.5	64	-11	9	2.13	1.04	3.01	5	4.2
February---	39.8	21.4	30.6	66	-7	21	2.06	.98	2.93	4	4.2
March------	49.9	30.8	40.4	79	7	166	3.02	1.48	4.27	7	2.7
April------	64.0	42.8	53.4	84	24	402	4.01	2.30	5.40	8	.2
May--------	74.0	51.7	62.9	91	30	710	4.42	2.50	5.99	8	.0
June-------	82.5	60.5	71.6	95	44	948	4.04	2.28	5.47	7	.0
July-------	86.3	64.0	75.2	98	48	1,091	4.41	2.04	6.33	7	.0
August-----	84.9	62.1	73.5	96	48	1,039	2.96	1.41	4.22	5	.0
September--	79.2	55.1	67.2	93	36	816	3.27	1.39	4.79	5	.0
October----	68.1	43.8	56.0	87	24	496	2.20	1.03	3.15	5	.0
November---	52.1	32.9	42.5	77	10	141	3.25	1.72	4.49	6	.7
December---	39.8	23.1	31.5	66	-5	61	2.68	1.05	4.00	6	2.2
Yearly:											
Average--	63.0	42.2	52.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	99	-12	---	---	---	---	---	---
Total----	---	---	---	---	---	5,900	38.45	32.09	44.54	73	14.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1955-76 at Terre Haute]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 9	April 22	May 11
2 years in 10 later than--	April 4	April 18	May 5
5 years in 10 later than--	March 26	April 10	April 22
First freezing temperature in fall:			
1 year in 10 earlier than--	October 22	October 14	October 1
2 years in 10 earlier than--	October 27	October 19	October 6
5 years in 10 earlier than--	November 6	October 28	October 15

TABLE 3.--GROWING SEASON

[Recorded in the period 1955-76 at Terre Haute]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	206	180	151
8 years in 10	212	187	159
5 years in 10	224	201	175
2 years in 10	236	214	191
1 year in 10	242	221	199

TABLE 4.--POTENTIAL AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map Unit	Percent of area	Cultivated crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas
1. Iva	40	Good	Good	Good	Poor: wetness.	Poor: wetness.
2. Hickory-Cincinnati-Ava	25	Poor: slope.	Poor: slope.	Good	Fair: slope.	Poor: slope.
3. Stendal-Shoals-Newark	13	Fair: floods, wetness.	Poor: floods, wetness.	Good	Poor: floods.	Poor: floods, wetness.
4. Chagrin-Nolin-Wilbur	8	Fair: floods.	Fair: floods.	Good	Poor: floods.	Fair: floods.
5. Alvin-Princeton-Ayrshire	4	Fair: slope.	Good	Good	Good	Fair: slope.
6. Hickory-Muren-Cincinnati	6	Poor: slope.	Poor: slope.	Good	Fair: slope.	Poor: slope.
7. Evansville-Peoga-Zipp	4	Good	Fair: wetness.	Good	Poor: wetness.	Poor: wetness.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AnC	Alvin loamy fine sand, 4 to 12 percent slopes	1,827	0.8
AvB2	Ava silt loam, 2 to 6 percent slopes, eroded	19,667	8.3
Ay	Ayrshire fine sandy loam	2,083	0.9
BdF	Berks-Gilpin complex, 30 to 70 percent slopes	1,055	0.5
BmD	Bloomfield loamy fine sand, 12 to 18 percent slopes	218	0.1
BmF	Bloomfield loamy fine sand, 25 to 50 percent slopes	420	0.2
Bo	Bonnie silt loam, frequently flooded	4,357	1.9
Ca	Chagrin silt loam, occasionally flooded	4,753	2.0
Cb	Chagrin-Stonelick complex, occasionally flooded	3,166	1.4
CcC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded	1,627	0.7
CcC3	Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	10,715	4.6
CeC3	Cincinnati Variant silt loam, 6 to 12 percent slopes, severely eroded	1,141	0.5
ChF	Chetwynd loam, 25 to 70 percent slopes	751	0.3
CoA	Cory silt loam, 0 to 2 percent slopes	1,859	0.8
Ev	Evansville silt loam, occasionally flooded	5,613	2.4
FcB	Fairpoint shaly silt loam, 0 to 8 percent slopes	336	0.1
FcG	Fairpoint shaly silty clay loam, 33 to 90 percent slopes	15,792	6.7
GmE	Gilpin-Wellston silt loams, 18 to 30 percent slopes	1,075	0.5
HbA	Henshaw silt loam, 1 to 3 percent slopes	1,066	0.5
HcD	Hickory silt loam, 12 to 18 percent slopes	2,012	0.9
HcD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded	2,636	1.1
HcE	Hickory loam, 18 to 25 percent slopes	6,483	2.8
HcF	Hickory loam, 30 to 70 percent slopes	6,885	3.0
Ho	Hoosierville silt loam	7,577	3.3
IvA	Iva silt loam, 0 to 2 percent slopes	45,846	19.5
Lo	Lobdell loam, occasionally flooded	3,204	1.4
Ly	Lyles fine sandy loam	937	0.4
Mt	Montgomery Variant silty clay loam	657	0.3
MuA	Muren silt loam, 0 to 2 percent slopes	3,025	1.3
MuB2	Muren silt loam, 2 to 6 percent slopes, eroded	13,260	5.7
Ne	Newark silt loam, frequently flooded	5,890	2.5
No	Nolin silt loam, rarely flooded	1,711	0.7
Nr	Nolin silty clay loam, rarely flooded	601	0.3
PaD2	Parke silt loam, 12 to 18 percent slopes, eroded	474	0.2
Pf	Peoga silt loam	3,051	1.3
Pg	Petrolia silty clay loam, frequently flooded	1,060	0.5
PkA	Pike silt loam, 0 to 2 percent slopes	392	0.2
PkB2	Pike silt loam, 2 to 6 percent slopes, eroded	5,476	2.4
PkC2	Pike silt loam, 6 to 12 percent slopes, eroded	957	0.4
PnB	Princeton fine sandy loam, 2 to 6 percent slopes	1,703	0.7
PnC	Princeton fine sandy loam, 6 to 12 percent slopes	891	0.4
Sh	Shoals silt loam, frequently flooded	7,908	3.4
Sk	Steff silt loam, occasionally flooded	3,210	1.4
Sn	Stendal silt loam, frequently flooded	10,770	4.6
VgA	Vigo silt loam, 0 to 2 percent slopes	9,208	4.0
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded	261	0.1
Wm	Wilbur silt loam, occasionally flooded	2,156	0.9
Zp	Zipp silty clay, frequently flooded	3,794	1.6
Zs	Zipp silty clay loam, overwash, frequently flooded	390	0.2
	Water	3,014	1.3
	Total	232,960	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AnC Alvin	80	27	45	4.0	8.0
AvB2 Ava	100	33	48	4.3	7.1
Ay Ayrshire	115	40	46	3.8	7.6
BdF Berks-Gilpin	---	---	---	---	---
BmD, BmF Bloomfield	---	---	---	---	---
Bo Bonnie	113	40	40	4.0	8.0
Ca Chagrin	125	40	---	4.5	9.0
Cb Chagrin-Stonelick	109	36	---	4.1	8.2
CcC2 Cincinnati	100	30	40	4.5	9.0
CcC3 Cincinnati	90	25	35	4.0	8.0
CeC3 Cincinnati Variant	80	22	32	3.5	7.0
ChF Chetwynd	---	---	---	---	3.2
CoA Cory	140	49	56	4.6	9.2
Ev Evansville	145	51	58	4.8	9.6
FcB Fairpoint	---	---	---	---	---
FcG Fairpoint	---	---	---	---	---
GmE Gilpin-Wellston	83	---	---	2.9	5.8
HbA Henshaw	120	45	50	4.0	8.0
HcD Hickory	85	24	27	2.8	5.6
HcD3, HcE Hickory	---	---	---	2.4	4.8
HcF Hickory	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Ho----------------------- Hoosierville	145	50	58	4.8	9.6
IvA---------------------- Iva	135	47	54	4.4	8.8
Lo----------------------- Lobdell	120	40	---	4.5	9.0
Ly----------------------- Lyles	125	47	54	4.4	8.8
Mt----------------------- Montgomery Variant	125	42	48	4.0	8.0
MuA---------------------- Muren	125	44	50	4.1	8.2
MuB2--------------------- Muren	120	42	48	4.0	8.0
Ne----------------------- Newark	120	40	---	4.5	9.0
No, Nr------------------- Nolin	125	45	---	4.5	9.0
PaD2--------------------- Parke	90	27	36	3.0	6.0
Pf----------------------- Peoga	135	44	50	4.1	8.2
Pg----------------------- Petrolia	120	38	45	4.2	8.4
PkA---------------------- Pike	120	42	48	4.0	8.0
PkB2--------------------- Pike	115	40	46	3.8	7.6
PkC2--------------------- Pike	105	37	42	3.4	6.8
PnB---------------------- Princeton	100	35	43	3.1	6.2
PnC---------------------- Princeton	90	27	38	2.8	5.6
Sh----------------------- Shoals	120	40	---	4.5	9.0
Sk----------------------- Steff	120	40	---	4.5	9.0
Sn----------------------- Stendal	120	40	50	4.3	8.6
VgA---------------------- Vigo	120	40	50	3.6	7.2
WeD2--------------------- Wellston	85	24	35	3.5	7.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Wm-------------------------- Wilbur	125	44	50	4.1	8.2
Zp-------------------------- Zipp	85	37	---	3.6	7.2
Zs-------------------------- Zipp	90	40	---	3.6	7.2

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	8,939	---	---	---
II	144,565	40,106	104,459	---
III	26,524	5,638	20,886	---
IV	14,342	14,342	---	---
V	---	---	---	---
VI	10,673	10,455	---	218
VII	24,903	24,483	---	420
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
AnC----------------- Alvin	2o	Slight	Slight	Slight	Slight	White oak------------ Northern red oak----- Black walnut--------- Yellow-poplar---------	80 80 --- 90	Green ash, black walnut, yellow-poplar, white oak, eastern white pine, American sycamore, sugar maple.
AvB2---------------- Ava	2o	Slight	Slight	Slight	Slight	White oak------------ Northern red oak----- Yellow-poplar--------- Black walnut---------	75 80 90 ---	Eastern cottonwood, sweetgum, yellow-poplar, white oak, American sycamore.
Ay------------------ Ayrshire	1o	Slight	Slight	Slight	Slight	White oak------------ Pin oak-------------- Yellow-poplar--------- Sweetgum-------------	85 100 100 100	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
BdF*: Berks---------------	3f	Moderate	Severe	Moderate	Slight	Northern red oak----- Black oak------------ Virginia pine--------	70 70 70	Virginia pine, eastern white pine, Japanese larch, red pine.
Gilpin--------------	2r	Severe	Severe	Slight	Slight	Northern red oak----- Yellow-poplar--------	80 95	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
BmD, BmF----------- Bloomfield	3s	Moderate	Moderate	Moderate	Slight	Black oak------------ White oak------------ Scarlet oak----------	70 --- ---	Eastern white pine, red pine, jack pine.
Bo------------------ Bonnie	2w	Slight	Severe	Severe	Severe	Pin oak-------------- Eastern cottonwood--- Sweetgum------------- Cherrybark oak------- American sycamore---	90 100 --- --- ---	Eastern cottonwood, red maple, American sycamore, sweetgum, pin oak.
Ca------------------ Chagrin	1o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar--------- Sugar maple---------- White oak------------ Black cherry--------- White ash------------ Black walnut---------	86 96 86 --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
Cb*: Chagrin------------	1o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar--------- Sugar maple---------- White oak------------ Black cherry--------- White ash------------ Black walnut---------	86 96 86 --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
Stonelick-----------	2o	Slight	Slight	Slight	Slight	Northern red oak----- White oak------------ Black walnut--------- Black cherry--------- Sugar maple---------- White ash------------ Yellow-poplar--------	80 --- --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
CcC2, CcC3 Cincinnati	2d	Slight	Slight	Moderate	Moderate	Northern red oak White oak Black walnut Black cherry Sugar maple White ash Yellow-poplar	80 --- --- --- --- --- ---	Eastern white pine, yellow-poplar, white ash, red pine, northern red oak, white oak.
CeC3 Cincinnati Variant	2d	Slight	Slight	Moderate	Moderate	Northern red oak White oak Black walnut Black cherry	80 --- --- ---	Eastern white pine, yellow-poplar.
ChF Chetwynd	1r	Severe	Severe	Slight	Slight	Yellow-poplar Northern red oak	99 88	Eastern white pine, black walnut, yellow-poplar, red pine.
CoA Cory	---	--------	--------	--------	--------	---	---	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Ev Evansville	2w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, red maple, white ash, sweetgum.
FcB, FcG Fairpoint	---	--------	--------	--------	--------	---	---	Eastern white pine, yellow-poplar.
GmE*:								
Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	80 95	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
Wellston	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar Virginia pine	81 97 76	Eastern white pine, black walnut, yellow-poplar.
HbA Henshaw	1w	Slight	Moderate	Slight	Severe	Pin oak Yellow-poplar Sweetgum	95 95 95	White ash, sweetgum, eastern cottonwood, yellow-poplar.
HcD Hickory	1o	Slight	Slight	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	86 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.
HcD3, HcE Hickory	1r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	86 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut
HcF Hickory	1r	Severe	Severe	Slight	Slight	White oak Northern red oak Black oak Green ash Bitternut hickory Yellow-poplar	86 85 --- --- --- 95	Eastern white pine, red pine, yellow-poplar, sugar maple, white oak, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Ho------------------- Hoosierville	3w	Slight	Severe	Moderate	Moderate	Pin oak-------------- White oak------------ Sweetgum--------------	85 70 85	Eastern white pine, red maple, white ash, sweetgum.
IvA------------------ Iva	2o	Slight	Slight	Slight	Slight	White oak------------ Pin oak-------------- Yellow-poplar-------- Sweetgum--------------	75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
Lo------------------- Lobdell	1o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar-------- Sugar maple---------- Black walnut--------- White oak------------ Black cherry--------- White ash------------	87 96 --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, northern red oak, white oak.
Ly------------------- Lyles	2w	Slight	Severe	Severe	Severe	Pin oak-------------- White oak------------ Sweetgum-------------- Northern red oak-----	88 75 90 76	Eastern white pine, red maple, white ash, sweetgum.
Mt------------------- Montgomery Variant	2w	Slight	Severe	Severe	Severe	Pin oak-------------- White oak------------ Sweetgum--------------	88 75 90	Eastern white pine, red maple, white ash, sweetgum.
MuA, MuB2------------ Muren	1o	Slight	Slight	Slight	Slight	White oak------------ Yellow-poplar-------- Sweetgum--------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Ne------------------- Newark	1o	Slight	Slight	Slight	Slight	Pin oak-------------- Eastern cottonwood--- Northern red oak----- Yellow-poplar-------- Sweetgum--------------	99 94 85 95 88	Eastern cottonwood, sweetgum, post oak, red maple, American sycamore, eastern white pine, yellow-poplar.
No, Nr--------------- Nolin	3o	Slight	Slight	Slight	Slight	Sweetgum--------------	85	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash.
PaD2----------------- Parke	1o	Slight	Slight	Slight	Slight	White oak------------ Yellow-poplar-------- Sweetgum--------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Pf------------------- Peoga	2w	Slight	Severe	Severe	Moderate	Pin oak-------------- White oak------------ Sweetgum--------------	90 75 90	Eastern white pine, red maple, white ash, sweetgum.
Pg------------------- Petrolia	2w	Slight	Moderate	Moderate	Severe	Eastern cottonwood--- Pin oak-------------- Sweetgum-------------- Cherrybark oak------- American sycamore----	100 90 --- --- ---	Eastern cottonwood, red maple, American sycamore, water tupelo.
PkA, PkB2, PkC2----- Pike	1o	Slight	Slight	Slight	Slight	White oak------------ Yellow-poplar-------- Sweetgum--------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
PnB, PnC----------- Princeton	1o	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum------------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
Sh----------------- Shoals	2o	Slight	Slight	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine------- Eastern cottonwood-- White ash-----------	90 86 90 90 --- ---	Sweetgum, red maple, swamp chestnut oak, pin oak, yellow-poplar.
Sk----------------- Steff	1o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 95	Yellow-poplar, eastern white pine, sweetgum, black walnut.
Sn----------------- Stendal	2o	Slight	Slight	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 85 90 90	Eastern white pine, American sycamore, red maple, white ash.
VgA---------------- Vigo	2w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Pin oak------------- Sweetgum------------ American sycamore--- White oak----------- Northern red oak----	100 90 90 --- --- ---	Eastern white pine, red maple, sweetgum, white ash.
WeD2--------------- Wellston	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	81 97 76	Eastern white pine, black walnut, yellow-poplar.
Wm----------------- Wilbur	1o	Slight	Slight	Slight	Slight	Yellow-poplar-------	100	Eastern white pine, black walnut, yellow-poplar.
Zp, Zs------------- Zipp	2w	Slight	Severe	Severe	Severe	Pin oak------------- White oak----------- Sweetgum------------	86 75 90	Eastern white pine, red maple, white ash, sweetgum.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AnC: Alvin	---	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, Tatarian honeysuckle.	Austrian pine, northern white-cedar, osageorange, eastern redcedar.	Eastern white pine, red pine, Norway spruce.	---
AvB2: Ava	---	Washington hawthorn, Amur privet, eastern redcedar, Tatarian honeysuckle, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Ay: Ayrshire	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
BdF*:					
Berks	Siberian peashrub	Autumn-olive, lilac, Tatarian honeysuckle, eastern redcedar, radiant crabapple, Washington hawthorn.	Norway spruce, Scotch pine, red pine, eastern white pine, Austrian pine, jack pine.	---	---
Gilpin	Siberian peashrub	Autumn-olive, lilac, Tatarian honeysuckle, eastern redcedar, radiant crab-apple, Washington hawthorn.	Norway spruce, Scotch pine, red pine, eastern white pine, Austrian pine, jack pine.	---	---
BmD, BmF: Bloomfield	Siberian peashrub	Eastern redcedar, autumn-olive, radiant crab-apple, Washington hawthorn, Amur honeysuckle, lilac, Tatarian honeysuckle.	Norway spruce, red pine, jack pine, Austrian pine.	Eastern white pine	---
Bo: Bonnie	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	White fir, blue spruce, Washington hawthorn, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Ca----------------- Chagrin	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Cb*:					
Chagrin-----------	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Stonelick--------	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
CcC2, CcC3-------- Cincinnati	---	Eastern redcedar, Washington hawthorn, honeysuckle, Amur arrowwood, American cranberrybush.	Green ash, Austrian pine, osageorange.	Pin oak, eastern white pine.	---
CeC3--------------- Cincinnati Variant	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
ChF--------------- Chetwynd	---	Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
CoA--------------- Cory	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Ev---------------- Evansville	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
FcB, FcG. Fairpoint					
GmE*:					
Gilpin	Siberian peashrub	Autumn-olive, lilac, Tatarian honeysuckle, eastern redcedar, radiant crab-apple, Washington hawthorn.	Norway spruce, Scotch pine, red pine, eastern white pine, Austrian pine, jack pine.	---	---
Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
HbA Henshaw	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
HcD Hickory	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
HcD3, HcE, HcF. Hickory					
Ho Hoosierville	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
IvA Iva	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Lo Lobdell	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
Ly Lyles	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Mt: Montgomery Variant	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
MuA, MuB2: Muren	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Ne: Newark	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
No, Nr: Nolin	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
PaD2: Parke	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
Pf: Peoga	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Pg: Petrolia	---	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	White fir, blue spruce, Washington hawthorn, Norway spruce, Austrian pine, northern white-cedar.	Eastern white pine	Pin oak.
PkA, PkB2, PkC2: Pike	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
PnB, PnC: Princeton	---	Washington hawthorn, Amur honeysuckle, American cranberrybush, Amur privet, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, osageorange, northern white-cedar.	Eastern white pine, Norway spruce, red pine.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Sh----------------- Shoals	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Sk----------------- Steff	---	Amur honeysuckle, silky dogwood, Amur privet, American cran-berrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Sn----------------- Stendal	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
VgA---------------- Vigo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
WeD2--------------- Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Wm----------------- Wilbur	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Zp, Zs------------- Zipp	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir.	Eastern white pine	Pin oak.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AnC: Alvin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AvB2: Ava	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Ay: Ayrshire	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BdF*:					
Berks	Severe: slope, small stones.	Severe: small stones, slope.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BmD: Bloomfield	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
BmF: Bloomfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bo: Bonnie	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Ca: Chagrin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Cb*:					
Chagrin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Stonelick	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, droughty, flooding.
CcC2, CcC3: Cincinnati	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CeC3: Cincinnati Variant	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
ChF: Chetwynd	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CoA: Cory	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ev: Evansville	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.
FcB: Fairpoint	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: erodes easily.	Severe: small stones, droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FcG: Fairpoint	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: small stones, droughty, slope.
GmE*:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
HbA: Henshaw	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
HcD: Hickory	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
HcD3, HcE: Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
HcF: Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Ho: Hoosierville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
IvA: Iva	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Lo: Lobdell	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
Ly: Lyles	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mt: Montgomery Variant	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, erodes easily.	Severe: ponding.
MuA: Muren	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
MuB2: Muren	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Ne: Newark	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, erodes easily.	Severe: wetness, flooding.
No, Nr: Nolin	Severe: flooding.	Slight	Slight	Slight	Slight.
PaD2: Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Pf: Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pg: Petrolia	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
PkA------------------- Pike	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
PkB2------------------ Pike	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
PkC2------------------ Pike	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
PnB------------------- Princeton	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
PnC------------------- Princeton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Sh-------------------- Shoals	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Sk-------------------- Steff	Severe: flooding.	Moderate: wetness.	Moderate: flooding, wetness.	Severe: erodes easily.	Moderate: wetness, flooding.
Sn-------------------- Stendal	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
VgA------------------- Vigo	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
WeD2------------------ Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Wm-------------------- Wilbur	Severe: flooding.	Slight----------	Severe: flooding.	Slight------------	Severe: flooding.
Zp, Zs---------------- Zipp	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
AnC-----Alvin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AvB2-----Ava	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ay-----Ayrshire	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BdF*:										
Berks-----	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Gilpin-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
BmD, BmF-----Bloomfield	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Bo-----Bonnie	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Ca-----Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Cb*:										
Chagrin-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Stonelick-----	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
CcC2, CcC3-----Cincinnati	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CeC3-----Cincinnati Variant	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ChF-----Chetwynd	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CoA-----Cory	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Ev-----Evansville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
FcB-----Fairpoint	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.
FcG-----Fairpoint	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
GmE*:										
Gilpin-----	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Wellston-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HbA-----Henshaw	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
HcD: Hickory	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HcD3, HcE: Hickory	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HcF: Hickory	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Ho: Hoosierville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
IvA: Iva	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Lo: Lobdell	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ly: Lyles	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Mt: Montgomery Variant	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MuA, MuB2: Muren	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ne: Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
No, Nr: Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PaD2: Parke	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pf: Peoga	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Pg: Petrolia	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
PkA, PkB2: Pike	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PkC2: Pike	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PnB: Princeton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PnC: Princeton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Sh: Shoals	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Sk: Steff	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sn: Stendal	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
VgA: Vigo	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
WeD2---------------- Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Wm------------------ Wilbur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Zp, Zs-------------- Zipp	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AnC: Alvin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
AvB2: Ava	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope	Severe: low strength, frost action.	Slight.
Ay: Ayrshire	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: rrost action.	Moderate: wetness.
BdF*:						
Berks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BmD, BmF: Bloomfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bo: Bonnie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Ca: Chagrin	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Cb*:						
Chagrin	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Stonelick	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: small stones, droughty, flooding.
CcC2, CcC3: Cincinnati	Moderate: dense layer, wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
CeC3: Cincinnati Variant	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
ChF: Chetwynd	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CoA: Cory	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ev: Evansville	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FcB----------------- Fairpoint	Moderate: large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: frost action, shrink-swell.	Severe: small stones, droughty.
FcG----------------- Fairpoint	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: small stones, droughty, slope.
GmE*:						
Gilpin-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wellston----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
HbA----------------- Henshaw	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
HcD----------------- Hickroy	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope. shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
HcD3, HcE, HcF----- Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ho------------------ Hoosierville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
IvA----------------- Iva	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Lo------------------ Lobdell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Ly------------------ Lyles	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Mt------------------ Montgomery Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding.
MuA----------------- Muren	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
MuB2---------------- Muren	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Ne------------------ Newark	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
No, Nr-------------- Nolin	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PaD2: Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Pf: Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Pg: Petrolia	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
PkA: Pike	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
PkB2: Pike	Slight	Slight	Slight	Moderate: slope.	Severe: low strength, frost action.	Slight.
PkC2: Pike	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
PnB: Princeton	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
PnC: Princeton	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Sh: Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
Sk: Steff	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Sn: Stendal	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, low strength.	Severe: flooding.
VgA: Vigo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
WeD2: Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Wm: Wilbur	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Zp, Zs: Zipp	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AnC----------------- Alvin	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
AvB2---------------- Ava	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
Ay------------------ Ayrshire	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
BdF*:					
Berks---------------	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, small stones, area reclaim.
Gilpin--------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
BmD, BmF------------ Bloomfield	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
Bo------------------ Bonnie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Ca------------------ Chagrin	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Cb*:					
Chagrin-------------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Stonelick-----------	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: seepage.
CcC2, CcC3---------- Cincinnati	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
CeC3---------------- Cincinnati Variant	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
ChF----------------- Chetwynd	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
CoA----------------- Cory	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ev------------------ Evansville	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack, flooding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FcB----------------- Fairpoint	Severe: percs slowly.	Moderate: slope, large stones.	Moderate: too clayey, large stones.	Slight-----------	Poor: small stones.
FcG----------------- Fairpoint	Severe: percs slowly, slope, slippage.	Severe: slope.	Severe: slope, slippage.	Severe: slope.	Poor: small stones, slope.
GmE*: Gilpin--------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Wellston------------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
HbA----------------- Henshaw	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
HcD----------------- Hickory	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
HcD3, HcE, HcF------ Hickory	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ho------------------ Hoosierville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness, hard to pack.
IvA----------------- Iva	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Lo------------------ Lobdell	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Ly------------------ Lyles	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
Mt------------------ Montgomery Variant	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack. ponding.
MuA, MuB2----------- Muren	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Ne------------------ Newark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
No, Nr-------------- Nolin	Moderate: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
PaD2---------------- Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pf----------------- Peoga	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Pg----------------- Petrolia	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
PkA---------------- Pike	Slight------------	Moderate: seepage.	Severe: seepage.	Slight------------	Fair: too clayey.
PkB2--------------- Pike	Slight------------	Moderate: seepage, slope.	Severe: seepage.	Slight------------	Fair: too clayey.
PkC2--------------- Pike	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: too clayey, slope.
PnB---------------- Princeton	Slight------------	Severe: seepage.	Severe: seepage.	Slight------------	Good.
PnC---------------- Princeton	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
Sh----------------- Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Sk----------------- Steff	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Fair: too clayey, wetness.
Sn----------------- Stendal	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
VgA---------------- Vigo	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
WeD2--------------- Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Wm----------------- Wilbur	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Zp, Zs------------- Zipp	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AnC: Alvin	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
AvB2: Ava	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ay: Ayrshire	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
BdF*:				
Berks	Poor: slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
BmD: Bloomfield	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
BmF: Bloomfield	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
Bo: Bonnie	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ca: Chagrin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Cb*:				
Chagrin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Stonelick	Good	Probable	Improbable: too sandy.	Poor: small stones.
CcC2, CcC3: Cincinnati	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
CeC3: Cincinnati Variant	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
ChF: Chetwynd	Poor: slope.	Probable	Probable	Poor: slope.
CoA: Cory	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ev: Evansville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
FcB: Fairpoint	Fair: large stones, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FcG: Fairpoint	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
GmE*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Wellston	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
HbA: Henshaw	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
HcD: Hickory	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
HcD3, HcE: Hickory	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HcF: Hickory	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ho: Hoosierville	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
IvA: Iva	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lo: Lobdell	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ly: Lyles	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Mt: Montgomery Variant	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MuA, MuB2: Muren	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ne: Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
No, Nr: Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PaD2: Parke	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Pf: Peoga	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pg: Petrolia	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
PkA, PkB2: Pike	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
PkC2: Pike	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
PnB: Princeton	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
PnC: Princeton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Sh: Shoals	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sk: Steff	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
Sn: Stendal	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
VgA: Vigo	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WeD2: Wellston	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wm: Wilbur	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Zp, Zs: Zipp	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
AnC: Alvin	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
AvB2: Ava	Moderate: slope.	Severe: piping.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
Ay: Ayrshire	Moderate: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness.
BdF*:						
Berks	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Depth to rock, slope, large stones.	Droughty, depth to rock, slope.
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
BmD, BmF: Bloomfield	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, droughty, rooting depth.
Bo: Bonnie	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Ca: Chagrin	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Favorable	Favorable.
Cb*:						
Chagrin	Moderate: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Favorable	Favorable.
Stonelick	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
CcC2, CcC3: Cincinnati	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
CeC3: Cincinnati Variant	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, rooting depth.
ChF: Chetwynd	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope	Slope.
CoA: Cory	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
Ev: Evansville	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, flooding.	Wetness, erodes easily.
FcB: Fairpoint	Moderate: slope.	Severe: piping.	Severe: no water.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily.
FcG: Fairpoint	Severe: slope, slippage.	Severe: piping.	Severe: no water.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
GmE*:						
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
HbA Henshaw	Slight	Severe: piping, wetness.	Severe: slow refill.	Favorable	Erodes easily, wetness.	Wetness, erodes easily.
HcD, HcD3, HcE, HcF Hickory	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ho Hoosierville	Slight	Severe: wetness.	Severe: slow refill.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
IvA Iva	Moderate: seepage.	Severe: thin layer, wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Lo Lobdell	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
Ly Lyles	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding, soil blowing.	Wetness.
Mt Montgomery Variant	Slight	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
MuA Muren	Moderate: seepage.	Moderate: thin layer, wetness.	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
MuB2 Muren	Moderate: seepage, slope.	Moderate: thin layer, wetness.	Severe: slow refill.	Deep to water	Erodes easily	Erodes easily.
Ne Newark	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
No, Nr Nolin	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
PaD2 Parke	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Pf Peoga	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Pg Petrolia	Slight	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Wetness	Wetness.
PkA Pike	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
PkB2 Pike	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
PkC2 Pike	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
PnB: Princeton	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Soil blowing	Favorable.
PnC: Princeton	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
Sh: Shoals	Moderate: seepage.	Severe: wetness, piping.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Sk: Steff	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
Sn: Stendal	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
VgA: Vigo	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
WeD2: Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Wm: Wilbur	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Zp, Zs: Zipp	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
AnC-------------- Alvin	0-16	Loamy fine sand	SM	A-2	0	100	100	50-75	15-30	<20	NP-4
	16-65	Fine sandy loam, sandy loam, loamy fine sand.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	90-100	20-80	15-38	NP-13
	65-70	Stratified sandy loam to fine sand.	SM, SP, SP-SM	A-2, A-3	0-5	95-100	90-100	70-95	4-35	<20	NP-4
AvB2------------- Ava	0-8	Silt loam--------	CL	A-6, A-4	0	100	95-100	95-100	85-100	25-40	9-17
	8-22	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	95-100	30-45	15-25
	22-40	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	30-50	15-30
	40-80	Clay loam, silt loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	70-90	20-45	5-20
Ay--------------- Ayrshire	0-14	Fine sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	70-85	40-60	20-30	5-15
	14-45	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	100	100	80-90	35-55	25-35	10-15
	45-55	Sandy loam, fine sandy loam.	SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0	100	100	60-70	30-40	15-25	5-15
	55-60	Stratified fine sandy loam to fine sand.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	100	65-90	20-55	<20	NP-5
BdF*:											
Berks-----------	0-7	Channery silt loam, channery loam.	GM, ML, GC, SC	A-2, A-4	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	7-32	Channery loam, very channery loam, channery silt loam.	GM, SM, GC, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	32-38	Channery loam, very channery loam, channery silt loam.	GM, SM	A-1, A-2	0-40	35-65	25-55	20-40	15-35	24-38	2-10
	38	Weathered bedrock									
Gilpin----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	8-35	Channery loam, silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	35	Unweathered bedrock.									
BmD, BmF--------- Bloomfield	0-17	Loamy fine sand	SM, SP, SP-SM	A-2-4, A-3, A-4	0	100	100	70-90	4-40	---	NP
	17-75	Loamy fine sand, fine sandy loam, loamy sand.	SM, SP, SP-SM	A-2-4, A-4, A-3	0	100	100	65-80	4-40	<20	NP-3
	75-80	Fine sand--------	SP, SM, SP-SM	A-2-4, A-3	0	100	100	65-80	4-30	---	NP
Bo--------------- Bonnie	0-8	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	8-35	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	35-60	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-100	25-39	8-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Ca----------------- Chagrin	0-8	Silt loam---------	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	8-30	Silt loam, loam, sandy loam.	ML, SM	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
	30-60	Stratified silt loam to fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	50-85	15-80	20-40	NP-10
Cb*: Chagrin----------	0-7	Silt loam---------	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	7-50	Silt loam, loam, fine sandy loam.	ML, SM	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
	50-60	Stratified silt loam to fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	50-85	15-80	20-40	NP-10
Stonelick--------	0-8	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	70-100	45-75	25-55	<24	NP-6
	8-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0	85-100	70-95	40-60	5-40	<15	NP
CcC2, CcC3-------- Cincinnati	0-7	Silt loam---------	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	7-21	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	21-56	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	56-80	Clay loam, loam	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	5-20
CeC3-------------- Cincinnati Variant	0-6	Silt loam---------	CL	A-4, A-6	0	100	100	90-100	80-100	24-30	8-11
	6-20	Silty clay loam	CL	A-6	0	100	100	90-100	75-95	30-40	11-16
	20-50	Silt loam---------	CL	A-6, A-4	0	95-100	85-100	75-95	60-80	25-35	8-14
	50-80	Clay loam---------	CL	A-6, A-4	0-10	90-100	80-95	65-90	50-80	26-40	9-16
ChF--------------- Chetwynd	0-6	Loam--------------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	60-95	22-33	4-12
	6-18	Clay loam, sandy clay loam, loam.	SC, CL	A-4, A-6	0	90-100	85-100	70-95	40-75	20-35	8-18
	18-80	Sandy loam, loam, gravelly sandy clay loam.	SM-SC, SC, CL-ML, CL	A-2-4, A-2-6, A-4, A-6	0	70-95	65-95	60-90	30-65	20-32	5-15
CoA--------------- Cory	0-14	Silt loam---------	CL, CL-ML	A-4	0	100	100	90-100	70-90	<25	4-10
	14-65	Silty clay loam	CL	A-6	0	100	100	90-100	85-95	30-40	10-16
	65-70	Stratified silt loam, silty clay loam, clay loam.	CL, CL-ML, ML	A-4	0	100	100	95-100	85-95	<30	2-9
Ev---------------- Evansville	0-8	Silt loam---------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-98	25-40	3-15
	8-48	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-98	35-55	20-35
	48-60	Stratified silt loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-45	10-25
FcB--------------- Fairpoint	0-3	Shaly silt loam	CL, CL-ML, SC, GC	A-4, A-6, A-2	5-15	55-90	45-85	40-85	30-75	20-40	4-18
	3-60	Gravelly clay loam, very shaly silty clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
FcG--------------- Fairpoint	0-2	Shaly silty clay loam.	CL, SC, GC	A-6, A-7	5-20	55-90	45-85	40-85	35-80	35-50	12-24
	2-60	Gravelly clay loam, very shaly silty clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
GmE*:											
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-35	Channery loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	35-40	Channery loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	40	Unweathered bedrock.									
Wellston--------	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-46	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	46-54	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	54	Unweathered bedrock.									
HbA-------------- Henshaw	0-13	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	20-35	3-10
	13-60	Silty clay loam, silt loam.	CL, ML	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
	60-70	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
HcD, HcD3--------- Hickory	0-12	Silt loam--------	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	12-54	Clay loam--------	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	54-80	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
HcE, HcF--------- Hickory	0-16	Loam, silt loam--	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	16-56	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	56-60	Clay loam, sandy loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
Ho--------------- Hoosierville	0-13	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	70-90	27-36	8-15
	13-18	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-90	27-36	8-15
	18-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	85-95	38-54	20-32
	60-70	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	70-90	27-36	8-15
IvA-------------- Iva	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	12-51	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	80-100	35-50	15-30
	51-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
Lo--------------- Lobdell	0-8	Loam------------	ML, CL-ML, CL	A-4	0	95-100	90-100	80-100	65-90	20-30	NP-8
	8-52	Loam, silt loam	ML	A-4	0	90-100	80-100	70-95	55-85	20-35	NP-10
	52-60	Stratified sand to silt loam.	ML, SM, CL-ML, CL	A-4	0	90-100	80-100	65-85	40-80	15-35	NP-10
Ly--------------- Lyles	0-17	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	95-100	85-100	55-80	25-50	<20	NP-5
	17-55	Sandy loam, loam, fine sandy loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	95-100	85-100	50-80	35-60	20-30	4-14
	55-60	Stratified loamy fine sand to sandy clay loam.	SM, SM-SC, SC	A-4, A-6, A-1, A-2	0	95-100	85-100	45-85	15-40	15-35	NP-15
	60-70	Fine sand, sand	SP-SM, SM, SM-SC	A-2-4, A-1-b, A-3	0	95-100	85-100	45-75	5-30	<20	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Mt-----------------Montgomery Variant	0-11	Silty clay loam	CL	A-6	0	100	100	100	85-100	32-40	12-16
	11-80	Silty clay loam	CL	A-6	0	100	100	95-100	90-100	34-40	13-16
MuA, MuB2---------Muren	0-9	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	9-54	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	54-60	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
Ne-----------------Newark	0-9	Silt loam---------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	9-38	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-95	22-42	3-20
	38-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	3-20
No-----------------Nolin	0-12	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	12-43	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	43-60	Stratified silt loam to fine sandy loam.	ML, CL, CL-ML, GM	A-2, A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15
Nr-----------------Nolin	0-12	Silty clay loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	12-50	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	50-60	Loam, silt loam, fine sandy loam.	ML, CL, CL-ML, GM	A-2, A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15
PaD2---------------Parke	0-6	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	6-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	25-45	10-25
	29-80	Sandy clay loam, loam, sandy loam.	SC, CL	A-2, A-6	0-3	90-100	85-95	55-90	30-60	25-35	10-15
Pf-----------------Peoga	0-11	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	11-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	20-30
	60-70	Stratified silty clay loam to silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	35-50	10-25
Pg-----------------Petrolia	0-7	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-45	12-20
	7-60	Silty clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	95-100	80-100	60-100	20-45	8-20
PkA, PkB2, PkC2--Pike	0-9	Silt loam---------	CL	A-4, A-6	0	100	100	90-100	80-95	25-35	8-15
	9-50	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	80-90	30-45	10-25
	50-64	Silty clay loam, loam, sandy clay loam.	CL, SC	A-6, A-2-6	0	80-90	70-90	60-90	30-80	20-35	10-20
	64-80	Stratified sand to sandy clay loam.	CL-ML, ML, SM, SM-SC	A-4, A-2-4, A-1	0	70-90	65-85	35-70	15-65	<20	NP-5
PnB, PnC----------Princeton	0-8	Fine sandy loam	SM, SC, ML, CL	A-4, A-2-4	0	100	100	60-85	30-55	<25	NP-10
	8-37	Sandy clay loam, sandy loam, loam.	SC, CL	A-6	0	100	100	70-90	35-70	25-35	10-15
	37-60	Stratified loamy fine sand to loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-2-4, A-2-6	0	100	100	60-90	30-70	15-25	5-15
	60-70	Stratified fine sand to silt.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	100	65-90	20-55	<20	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sh----------------- Shoals	0-6	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	6-34	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	34-60	Stratified silt loam to sandy loam.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10
Sk----------------- Steff	0-9	Silt loam---------	ML	A-4	0	95-100	90-100	80-100	55-95	<35	NP-10
	9-30	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	20-40	3-20
	30-60	Silt loam, loam, fine sandy loam.	ML, CL-ML, SM, GM	A-4, A-2, A-1	0-10	50-100	40-100	35-95	20-90	<35	NP-10
Sn----------------- Stendal	0-9	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
	9-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
VgA---------------- Vigo	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-95	25-35	5-15
	8-25	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-95	25-35	5-15
	25-56	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	95-100	90-100	80-95	35-55	20-40
	56-80	Clay loam, loam	CL	A-4, A-6	0	95-100	90-100	80-95	55-80	20-40	8-20
WeD2--------------- Wellston	0-3	Silt loam---------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	3-34	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	34-51	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	51-60	Weathered bedrock									
Wm----------------- Wilbur	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	8-60	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
Zp----------------- Zipp	0-8	Silty clay--------	CH, CL	A-7	0	100	100	95-100	90-95	40-55	15-30
	8-45	Silty clay--------	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	45-60	Silty clay--------	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35
Zs----------------- Zipp	0-18	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-95	35-50	15-25
	18-53	Silty clay--------	CL, CH	A-7	0	100	100	95-100	90-95	45-60	25-35
	53-60	Silty clay--------	CL, CH	A-7	0	100	100	90-100	75-95	45-60	25-35

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
AnC-------------- Alvin	0-16	5-10	1.50-1.70	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-1
	16-65	15-18	1.45-1.65	2.0-6.0	0.12-0.20	4.5-6.0	Low-----------	0.24			
	65-70	3-10	1.55-1.75	6.0-20	0.05-0.13	5.1-7.8	Low-----------	0.24			
AvB2------------- Ava	0-8	20-27	1.30-1.50	0.6-2.0	0.22-0.24	3.6-7.3	Moderate-----	0.43	4	6	1-3
	8-22	22-35	1.40-1.60	0.2-0.6	0.18-0.20	3.6-5.5	Moderate-----	0.43			
	22-40	25-35	1.60-1.75	<0.06	0.09-0.10	3.6-5.5	Moderate-----	0.43			
	40-80	20-30	1.65-1.80	<0.06	0.05-0.08	3.6-5.5	Moderate-----	0.43			
Ay--------------- Ayrshire	0-14	5-12	1.35-1.50	0.6-2.0	0.18-0.20	5.6-6.5	Low-----------	0.24	5	3	.5-2
	14-45	22-32	1.40-1.55	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.32			
	45-55	8-20	1.45-1.60	0.6-2.0	0.12-0.14	5.1-6.5	Low-----------	0.32			
	55-60	4-10	1.40-1.60	2.0-6.0	0.06-0.08	6.6-8.4	Low-----------	0.20			
BdF*:											
Berks-----------	0-7	5-23	1.20-1.50	0.6-2.0	0.08-0.12	3.6-6.5	Low-----------	0.24	3	8	.5-3
	7-32	5-32	1.20-1.60	0.6-2.0	0.04-0.10	3.6-6.5	Low-----------	0.17			
	32-38	5-20	1.20-1.60	2.0-6.0	0.04-0.10	3.6-6.5	Low-----------	0.17			
	38	---	---	---	---	---	-------------	----			
Gilpin----------	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	6	1-4
	8-30	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.24			
	30-35	15-35	1.20-1.50	0.6-2.0	0.06-0.10	3.6-5.5	Low-----------	0.24			
	35	---	---	---	---	---	-------------	----			
BmD, BmF--------- Bloomfield	0-17	3-10	1.60-1.80	6.0-20	0.07-0.12	5.1-6.5	Low-----------	0.15	5	1	.5-2
	17-75	6-18	1.60-1.80	2.0-20	0.06-0.17	5.1-6.5	Low-----------	0.15			
	75-80	3-18	1.70-1.90	6.0-20	0.06-0.08	5.1-6.5	Low-----------	0.15			
Bo--------------- Bonnie	0-8	18-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.3	Low-----------	0.43	5	6	1-3
	8-35	18-25	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43			
	35-70	18-25	1.45-1.65	0.6-2.0	0.18-0.20	5.1-7.3	Low-----------	0.43			
Ca--------------- Chagrin	0-8	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	5	5	2-4
	8-30	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low-----------	0.32			
	30-60	5-25	1.20-1.40	0.6-2.0	0.08-0.20	5.6-7.3	Low-----------	0.32			
Cb*:											
Chagrin----------	0-7	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	5	5	2-4
	7-50	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low-----------	0.32			
	50-60	5-25	1.20-1.40	0.6-2.0	0.08-0.20	5.6-7.3	Low-----------	0.32			
Stonelick--------	0-8	8-18	1.25-1.50	2.0-6.0	0.09-0.14	7.4-8.4	Low-----------	0.24	5	3	.5-2
	8-60	5-18	1.20-1.55	2.0-6.0	0.05-0.11	7.4-8.4	Low-----------	0.24			
CcC2, CcC3------- Cincinnati	0-7	15-25	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.37	4-3	6	1-3
	7-21	22-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Low-----------	0.37			
	21-56	24-35	1.60-1.85	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
	56-80	24-40	1.55-1.75	0.06-0.6	0.08-0.12	4.5-6.5	Moderate-----	0.37			
CeC3------------- Cincinnati Variant	0-6	18-25	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	3	6	.5-1
	6-20	25-35	1.35-1.50	0.6-2.0	0.18-0.22	4.5-6.0	Low-----------	0.43			
	20-50	20-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	50-80	22-35	1.40-1.60	0.06-0.2	0.08-0.16	4.5-5.5	Low-----------	0.43			
ChF-------------- Chetwynd	0-6	12-24	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.32	5	5	1-3
	6-18	18-25	1.40-1.60	0.6-2.0	0.13-0.17	4.5-5.5	Moderate-----	0.32			
	18-80	18-25	1.35-1.60	0.6-2.0	0.11-0.17	4.5-6.0	Low-----------	0.32			
CoA-------------- Cory	0-14	13-20	1.25-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.32	3	5	2-3
	14-65	27-33	1.35-1.55	0.06-0.2	0.18-0.20	4.5-6.0	Moderate-----	0.32			
	65-70	10-20	1.35-1.55	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.32			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Ev----------------- Evansville	0-8	20-26	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.3	Low-----------	0.37	5	5	1-3
	8-48	25-34	1.40-1.55	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.37			
	48-60	25-34	1.40-1.55	0.6-2.0	0.19-0.21	6.6-8.4	Low-----------	0.37			
FcB---------------- Fairpoint	0-3	18-27	1.40-1.55	0.6-2.0	0.09-0.18	5.6-7.3	Low-----------	0.37	5	6	<.5
	3-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.37			
FcG---------------- Fairpoint	0-2	27-35	1.45-1.65	0.2-0.6	0.06-0.15	5.6-7.3	Moderate-----	0.37	5	6	<.5
	2-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.37			
GmE*:											
Gilpin-----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	6	1-4
	6-35	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.24			
	35-40	15-35	1.20-1.50	0.6-2.0	0.06-0.10	3.6-5.5	Low-----------	0.24			
	40	---	---	---	---	---	-------------	----			
Wellston---------	0-8	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
	8-46	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	46-54	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	54	---	---	---	---	---	-------------	----			
HbA---------------- Henshaw	0-13	12-27	---	0.6-2.0	0.18-0.23	5.6-6.5	Low-----------	0.43	4	6	.5-3
	13-60	18-34	---	0.2-0.6	0.15-0.19	5.1-7.3	Low-----------	0.43			
	60-70	15-34	---	0.2-0.6	0.17-0.22	6.6-8.4	Low-----------	0.43			
HcD, HcD3--------- Hickory	0-12	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37	5	6	1-3
	12-54	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate-----	0.37			
	54-80	15-22	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----------	0.37			
HcE, HcF---------- Hickory	0-16	19-25	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.37	5	6	1-3
	16-56	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate-----	0.37			
	56-60	15-22	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----------	0.37			
Ho----------------- Hoosierville	0-13	10-18	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low-----------	0.43	3	5	2-4
	13-18	16-24	1.35-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----------	0.43			
	18-60	26-32	1.40-1.60	0.2-0.6	0.18-0.20	4.5-6.0	Moderate-----	0.43			
	60-80	10-18	1.35-1.55	0.2-0.6	0.20-0.22	5.6-6.5	Low-----------	0.43			
IvA---------------- Iva	0-12	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	4	5	1-3
	12-51	22-30	1.35-1.55	0.06-0.2	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	51-60	10-20	1.35-1.55	0.6-2.0	0.20-0.22	5.6-6.5	Low-----------	0.43			
Lo----------------- Lobdell	0-8	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	1-3
	8-52	18-30	1.25-1.60	0.6-2.0	0.17-0.22	5.1-7.3	Low-----------	0.37			
	52-60	15-30	1.20-1.60	0.6-6.0	0.12-0.18	5.6-7.3	Low-----------	0.37			
Ly----------------- Lyles	0-17	7-20	1.40-1.60	0.6-2.0	0.14-0.18	6.1-7.8	Low-----------	0.20	5	3	3-6
	17-55	10-27	1.50-1.70	0.6-2.0	0.12-0.19	6.1-7.8	Low-----------	0.20			
	55-60	5-35	1.50-1.70	0.6-2.0	0.12-0.19	6.1-7.8	Low-----------	0.20			
	60-70	0-10	1.30-1.50	2.0-6.0	0.05-0.08	6.6-7.8	Low-----------	0.15			
Mt----------------- Montgomery Variant	0-11	28-35	1.35-1.55	0.2-0.6	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	7	3-6
	11-80	30-35	1.45-1.65	<0.2	0.18-0.20	5.1-6.0	Moderate-----	0.37			
MuA, MuB2--------- Muren	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-6.0	Low-----------	0.37	5-4	5	.5-3
	9-54	22-30	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.0	Moderate-----	0.37			
	54-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
Ne----------------- Newark	0-9	7-27	1.20-1.40	0.6-2.0	0.15-0.23	5.6-7.8	Low-----------	0.43	5	---	1-4
	9-38	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.8	Low-----------	0.43			
	38-60	12-40	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low-----------	0.43			
No----------------- Nolin	0-12	12-35	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43	5	---	2-4
	12-43	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43			
	43-60	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low-----------	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
Nr	0-12	12-35	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low	0.43	5	---	2-4
Nolin	12-50	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low	0.43			
	50-60	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low	0.43			
PaD2	0-6	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.37	5-4	5	.5-2
Parke	6-29	22-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-5.0	Moderate	0.37			
	29-80	20-30	1.55-1.65	0.6-2.0	0.16-0.18	4.5-5.5	Low	0.28			
Pf	0-11	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	4	5	1-3
Peoga	11-60	22-34	1.40-1.60	0.06-0.2	0.18-0.20	4.5-5.5	Moderate	0.43			
	60-70	20-34	1.40-1.60	0.06-0.2	0.19-0.21	4.5-6.5	Low	0.43			
Pg	0-7	27-35	1.20-1.40	0.2-0.6	0.21-0.23	5.6-6.0	Moderate	0.32	4	7	2-3
Petrolia	7-60	20-35	1.40-1.60	0.2-0.6	0.18-0.20	6.1-7.8	Moderate	0.32			
PkA, PkB2, PkC2	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5-4	5	.5-3
Pike	9-50	22-35	1.30-1.45	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.37			
	50-64	18-35	1.30-1.45	0.6-2.0	0.12-0.18	4.5-5.5	Low	0.37			
	64-80	14-20	1.45-1.65	2.0-6.0	0.05-0.12	4.5-8.4	Low	0.37			
PnB, PnC	0-8	12-20	1.35-1.50	0.6-2.0	0.13-0.18	5.6-7.3	Low	0.24	5-4	3	.5-2
Princeton	8-37	18-25	1.40-1.55	0.6-2.0	0.16-0.18	5.1-6.5	Low	0.32			
	37-60	8-18	1.40-1.55	2.0-6.0	0.12-0.14	5.1-7.3	Low	0.32			
	60-70	4-10	1.45-1.60	2.0-6.0	0.06-0.08	6.1-8.4	Low	0.17			
Sh	0-6	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.37	5	5	2-5
Shoals	6-34	18-32	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
	34-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-7.3	Low	0.37			
Sk	0-9	12-25	---	0.6-2.0	0.15-0.23	4.5-7.3	Low	0.43	5	---	1-3
Steff	9-30	12-34	---	0.6-2.0	0.18-0.23	4.5-5.5	Low	0.43			
	30-60	10-25	---	0.6-6.0	0.08-0.21	4.5-5.5	Low	0.43			
Sn	0-9	18-35	1.30-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	5	5	1-3
Stendal	9-60	18-35	1.45-1.65	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.37			
VgA	0-8	10-16	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	5	.5-2
Vigo	8-25	12-24	1.35-1.50	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43			
	25-56	24-35	1.40-1.55	<0.06	0.18-0.22	4.5-5.5	Moderate	0.43			
	56-80	20-30	1.40-1.55	<0.06	0.14-0.16	5.1-7.3	Moderate	0.43			
WeD2	0-3	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low	0.37	4	6	1-3
Wellston	3-34	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37			
	34-51	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37			
	51-60	---	---	---	---	---	---	---			
Wm	0-8	10-17	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	5	5	1-3
Wilbur	8-60	10-17	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
Zp	0-8	40-50	1.40-1.60	0.06-0.2	0.12-0.14	6.1-7.3	High	0.28	5	4	1-3
Zipp	8-45	40-55	1.45-1.70	<0.06	0.11-0.13	6.1-7.3	High	0.28			
	45-60	36-55	1.50-1.70	<0.06	0.08-0.10	6.1-7.8	High	0.28			
Zs	0-18	27-40	1.40-1.60	0.2-0.6	0.20-0.22	6.1-7.3	Moderate	0.28	5	7	1-3
Zipp	18-53	40-55	1.45-1.70	<0.06	0.11-0.13	6.1-7.3	High	0.28			
	53-60	36-55	1.50-1.70	<0.06	0.08-0.10	6.1-7.8	High	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
AnC: Alvin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
AvB2: Ava	C	None	---	---	2.0-4.0	Perched	Mar-Jun	>60	---	High	Moderate	High.
Ay: Ayrshire	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.
BdF*:												
Berks	C	None	---	---	>6.0	---	---	20-40	Soft	Low	Low	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	High.
BmD, BmF: Bloomfield	A	None	---	---	>6.0	---	---	>60	---	Low	Low	High.
Bo: Bonnie	C/D	Frequent	Long	Mar-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High	High	High.
Ca: Chagrin	B	Occasional	Brief	Nov-May	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low	Moderate.
Cb*:												
Chagrin	B	Occasional	Brief	Nov-May	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low	Moderate.
Stonelick	B	Occasional	Very brief	Nov-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
CcC2, CcC3: Cincinnati	C	None	---	---	>4.0	Perched	Jan-Apr	>60	---	High	Moderate	High.
CeC3: Cincinnati Variant	C	None	---	---	>6.0	---	---	>60	---	High	Moderate	High.
ChF: Chetwynd	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
CoA: Cory	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	High.
Ev: Evansville	B/D	Occasional	---	---	0-1.0	Apparent	Jan-May	>60	---	High	High	Low.
FcB, FcG: Fairpoint	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
GmE*:												
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
GmE*:												
Wellston----------	B	None---------	---	---	>6.0	---	---	>40	Hard	High-----	Moderate	High.
HbA---------------- Henshaw	C	None---------	---	---	1.0-2.0	Apparent	Nov-Mar	>60	---	High-----	High-----	Moderate.
HcD, HcD3, HcE, HcF--------------- Hickory	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Ho----------------- Hoosierville	C	None---------	---	---	0-1.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
IvA---------------- Iva	C	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Lo----------------- Lobdell	B	Occasional	Brief-----	Jan-Apr	2.0-3.5	Apparent	Dec-Apr	>60	---	High-----	Low------	Moderate.
Ly----------------- Lyles	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Mt----------------- Montgomery Variant	D	None---------	---	---	+1-1.0	Apparent	Dec-May	>60	---	Moderate	High-----	High.
MuA, MuB2---------- Muren	B	None---------	---	---	3.0-6.0	Apparent	Mar-Apr	>60	---	High-----	High-----	Moderate.
Ne----------------- Newark	C	Frequent----	Brief-----	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High-----	High-----	Low.
No, Nr------------- Nolin	B	Rare---------	---	---	3.0-6.0	Apparent	Feb-Mar	>60	---	High-----	Low------	Moderate.
PaD2--------------- Parke	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
Pf----------------- Peoga	C	None---------	---	---	0.-1.0	Apparent	Jan-May	>60	---	High-----	High-----	High.
Pg----------------- Petrolia	B/D	Frequent----	Long------	Mar-Jun	0-3.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Low.
PkA, PkB2, PkC2---- Pike	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	High.
PnB, PnC----------- Princeton	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Sh----------------- Shoals	C	Common------	Brief-----	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Sk----------------- Steff	C	Occasional	Brief------	Dec-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---	High------	Moderate	High.
Sn----------------- Stendal	C	Frequent----	Brief------	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High------	High------	High.
VgA---------------- Vigo	D	None---------	---	---	0.5-2.5	Apparent	Jan-Apr	>60	---	High------	High------	High.
WeD2--------------- Wellston	B	None---------	---	---	>6.0	---	---	>40	Hard	High------	Moderate	High.
Wm----------------- Wilbur	C	Occasional	Brief------	Oct-Jun	3.0-6.0	Apparent	Mar-Apr	>60	---	High------	Moderate	Moderate.
Zp----------------- Zipp	C/D	Frequent----	Brief------	Dec-May	0-1.0	Apparent	Dec-May	>60	---	Moderate	High------	Low.
Zs----------------- Zipp	C/D	Frequent----	Brief------	Dec-May	0-1.0	Apparent	Dec-May	>60	---	Moderate	High------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

Soil name and location	Parent material	SCS number	Depth	Moisture density: Maximum dry	Moisture density: Optimum moisture	Percentage passing sieve--: No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: 0.05 mm	0.02 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index	Classification: AASHTO	Classification: Unified
			In	lb/ft	Pct									Pct			
Pike silt loam: 1,000 feet east and 100 feet south of NW corner, sec. 13, T. 13 N., R. 6 W.	Loess over Illinoian outwash.	S75IN 21-1-1	0-6	104	18	100	99	98	92	85	60	15	8	31	19	A-6(12)	CL
		1-4	24-40	108	19	100	100	99	97	90	68	29	21	40	30	A-6(16)	CL
		1-6	56-74	119	12	100	100	90	65	61	41	16	10	26	8	A-4(6)	CL
		1-7	74-89	115	14	96	91	76	51	45	34	23	18	40	2	A-4(3)	ML
Iva silt loam: 1,400 feet west and 250 feet south of NE corner, sec. 18, T. 13 N., R. 6 W.	Loess.	S75IN 21-2-1	0-9	106	16	100	100	97	87	77	47	13	6	28	7	A-4(8)	ML-CL
		2-4	19-34	104	20	100	100	99	96	87	63	29	23	46	11	A-7-5 (10)	ML
		2-8	66-73	115	15	100	99	94	73	66	49	21	16	27	16	A-6(10)	CL
Vigo silt loam: 900 feet east and 1,700 feet north of SW corner, sec. 27, T. 10 N., R. 6 W.	Loess over Illinoian glacial till.	S76IN 21-1-1	0-8	105	13	100	99	95	84	72	42	14	7	27	15	A-6(10)	CL
		1-4	34-44	105	21	100	100	97	90	79	54	34	27	40	12	A-7-6 (9)	ML
		1-5	34-44	108	16	100	100	96	87	77	55	23	14	29	15	A-6(10)	CL
		1-7	56-90	116	15	100	99	95	71	68	42	23	19	31	21	A-6(12)	CL

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Alvin	Coarse-loamy, mixed, mesic Typic Hapludalfs
*Ava	Fine-silty, mixed, mesic Typic Fragiudalfs
Ayrshire	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Berks	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
*Bloomfield	Coarse-loamy, mixed, mesic Psammentic Hapludalfs
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
*Chagrin	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Chetwynd	Fine-loamy, mixed, mesic Typic Hapludults
Cincinnati	Fine-silty, mixed, mesic Typic Fragiudalfs
Cincinnati Variant	Fine-silty, mixed, mesic Typic Fragiudults
Cory	Fine-silty, mixed, mesic Mollic Ochraqualfs
Evansville	Fine-silty, mixed, nonacid, mesic Typic Haplaquepts
Fairpoint	Loamy-skeletal, mixed, nonacid, mesic Typic Udorthents
*Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
*Henshaw	Fine-silty, mixed, mesic Aquic Hapludalfs
Hickory	Fine-loamy, mixed, mesic Typic Hapludalfs
Hoosierville	Fine-silty, mixed, mesic Typic Ochraqualfs
Iva	Fine-silty, mixed, mesic Aeric Ochraqualfs
Lobdell	Fine-loamy, mixed, mesic Fluvaquentic Eutrochrepts
Lyles	Coarse-loamy, mixed, mesic Typic Haplaquolls
Montgomery Variant	Fine-silty, mixed, mesic Typic Haplaquolls
*Muren	Fine-silty, mixed, mesic Aquic Hapludalfs
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
*Parke	Fine-silty, mixed, mesic Ultic Hapludalfs
Peoga	Fine-silty, mixed, mesic Typic Ochraqualfs
Petrolia	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Pike	Fine-silty, mixed, mesic Ultic Hapludalfs
*Princeton	Fine-loamy, mixed, mesic Typic Hapludalfs
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Steff	Fine-silty, mixed, mesic Fluvaquentic Dystrochrepts
Stendal	Fine-silty, mixed, acid, mesic Aeric Fluvaquents
*Stonelick	Coarse-loamy, mixed (calcareous), mesic Typic Udifluvents
Vigo	Fine-silty, mixed, mesic Typic Glossaqualfs
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
*Wilbur	Coarse-silty, mixed, nonacid, mesic Aquic Udifluvents
Zipp	Fine, mixed, nonacid, mesic Typic Haplaquepts

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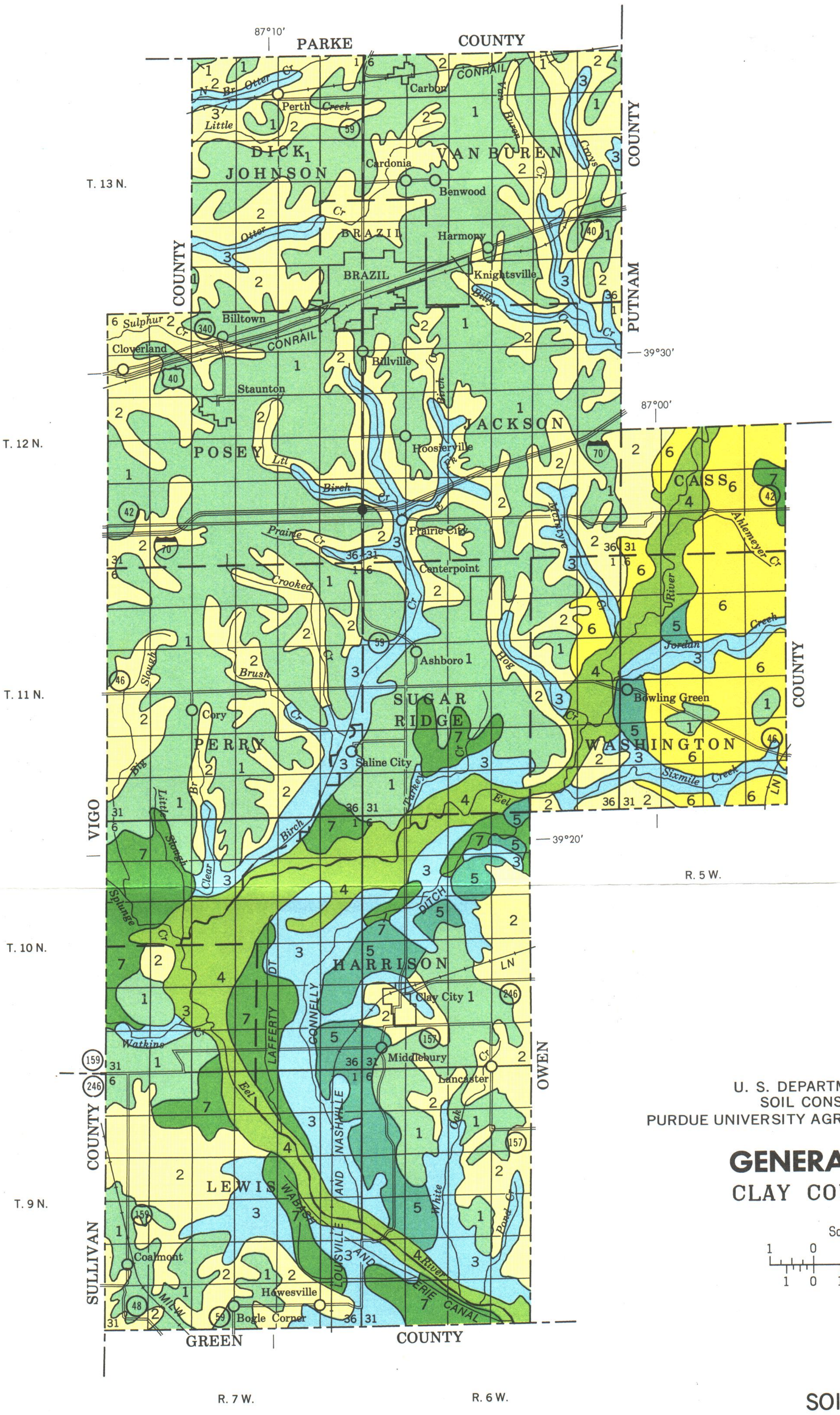


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
CLAY COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND

1 — Iva: Nearly level, somewhat poorly drained soils formed in loess; on uplands

2 — Hickory-Cincinnati-Ava: Gently sloping to very steep, well drained and moderately well drained soils formed in loess and the underlying glacial till; on uplands

3 — Stendal-Shoals-Newark: Nearly level, somewhat poorly drained soils formed in alluvium; on bottom lands

4 — Chagrin-Nolin-Wilbur: Nearly level, well drained and moderately well drained soils formed in alluvium; on bottom lands

5 — Alvin-Princeton-Ayrshire: Deep, nearly level to moderately sloping, well drained and somewhat poorly drained soils formed in wind-deposited sand and silt; on uplands

6 — Hickory-Muren-Cincinnati: Nearly level to very steep, well drained and moderately well drained soils formed in loess or in loess and the underlying glacial till; on uplands

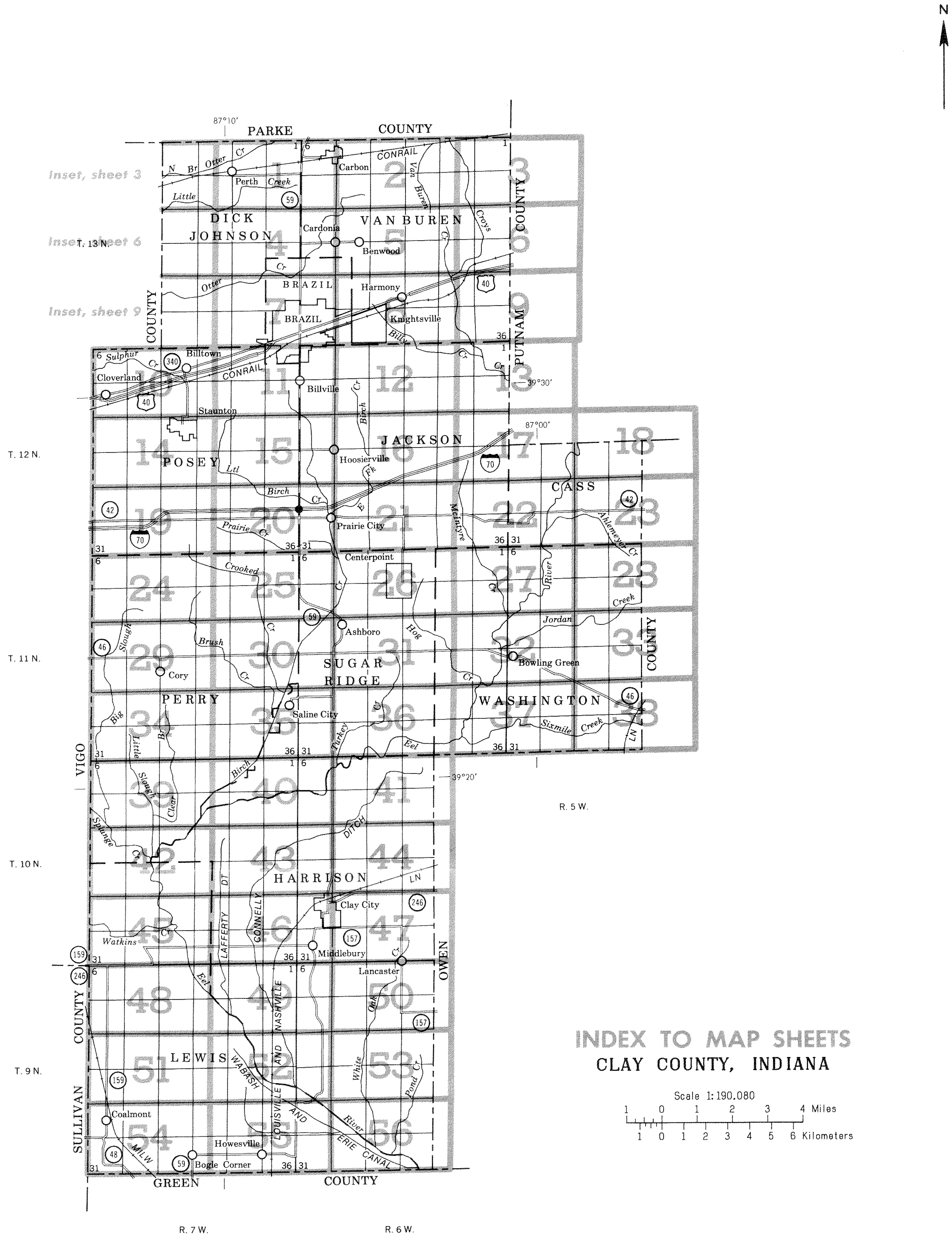
7 — Evansville-Peoga-Zip: Nearly level, poorly drained and very poorly drained soils formed in silty and clayey sediments; on lake plains, terraces, and bottom lands

Compiled 1981

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
CLAY COUNTY, INDIANA

Scale 1:190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils. A final number of 2 indicates that the soil is eroded and 3 that it is severely eroded.

SYMBOL	NAME
AnC	Alvin loamy fine sand, 4 to 12 percent slopes
AvB2	Ava silt loam, 2 to 6 percent slopes, eroded
Ay	Ayrshire fine sandy loam
BdF	Berks-Gilpin complex, 30 to 70 percent slopes
BmD	Bloomfield loamy fine sand, 12 to 18 percent slopes
BmF	Bloomfield loamy fine sand, 25 to 50 percent slopes
Bo	Bonnie silt loam, frequently flooded
Ca	Chagrin silt loam, occasionally flooded
Cb	Chagrin-Stonelick complex, occasionally flooded
CcC2	Cincinnati silt loam, 6 to 12 percent slopes, eroded
CcC3	Cincinnati silt loam, 6 to 12 percent slopes, severly eroded
CeC3	Cincinnati Variant silt loam, 6 to 12 percent slopes, severely eroded
ChF	Chetwynd loam, 25 to 70 percent slopes
CoA	Cory silt loam, 0 to 2 percent slopes
Ev	Evansville silt loam, occasionally flooded
FcB	Fairpoint shaly silt loam, 0 to 8 percent slopes
FcG	Fairpoint shaly silty clay loam, 33 to 90 percent slopes
GmE	Gilpin-Wellston silt loams, 18 to 30 percent slopes
HbA	Henshaw silt loam, 1 to 3 percent slopes
HcD	Hickory silt loam, 12 to 18 percent slopes
HcD3	Hickory silt loam, 12 to 18 percent slopes, severely eroded
HcE	Hickory loam, 18 to 25 percent slopes
HcF	Hickory loam, 30 to 70 percent slopes
Ho	Hoosierville silt loam
IvA	Iva silt loam, 0 to 2 percent slopes
Lo	Lobdell loam, occasionally flooded
Ly	Lyles fine sandy loam
Mt	Montgomery Variant silty clay loam
MuA	Muren silt loam, 0 to 2 percent slopes
MuB2	Muren silt loam, 2 to 6 percent slopes, eroded
Ne	Newark silt loam, frequently flooded
No	Nolin silt loam, rarely flooded
Nr	Nolin silty clay loam, rarely flooded
PaD2	Parke silt loam, 12 to 18 percent slopes, eroded
Pf	Peoga silt loam
Pg	Petrolia silty clay loam, frequently flooded
PkA	Pike silt loam, 0 to 2 percent slopes
PkB2	Pike silt loam, 2 to 6 percent slopes, eroded
PkC2	Pike silt loam, 6 to 12 percent slopes, eroded
PnB	Princeton fine sandy loam, 2 to 6 percent slopes
PnC	Princeton fine sandy loam, 6 to 12 percent slopes
Sh	Shoals silt loam, frequently flooded
Sk	Steff silt loam, occasionally flooded
Sn	Stendal silt loam, frequently flooded
VgA	Vigo silt loam, 0 to 2 percent slopes
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded
Wm	Wilbur silt loam, occasionally flooded
Zp	Zipp silty clay, frequently flooded
Zs	Zipp silty clay loam, overwash, frequently flooded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (AnC; WeD2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Spot of Fairpoint soils
- Spot of extremely acid mine spoil (#)

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CLAY COUNTY, INDIANA — SHEET NUMBER 2

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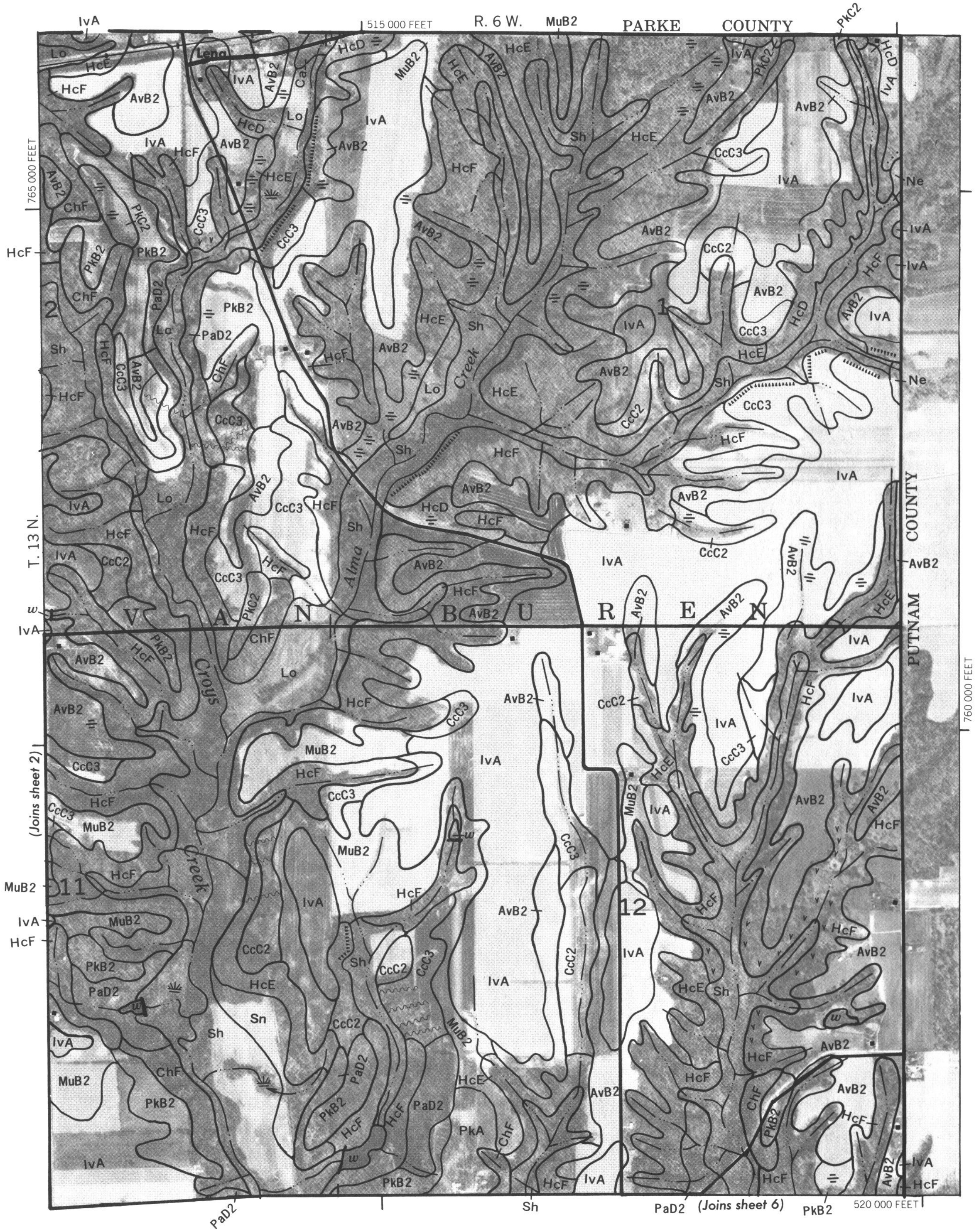
CLAY COUNTY, INDIANA NO. 2

3



N

1 Mile
5 000 Feet
Scale 1:15 840

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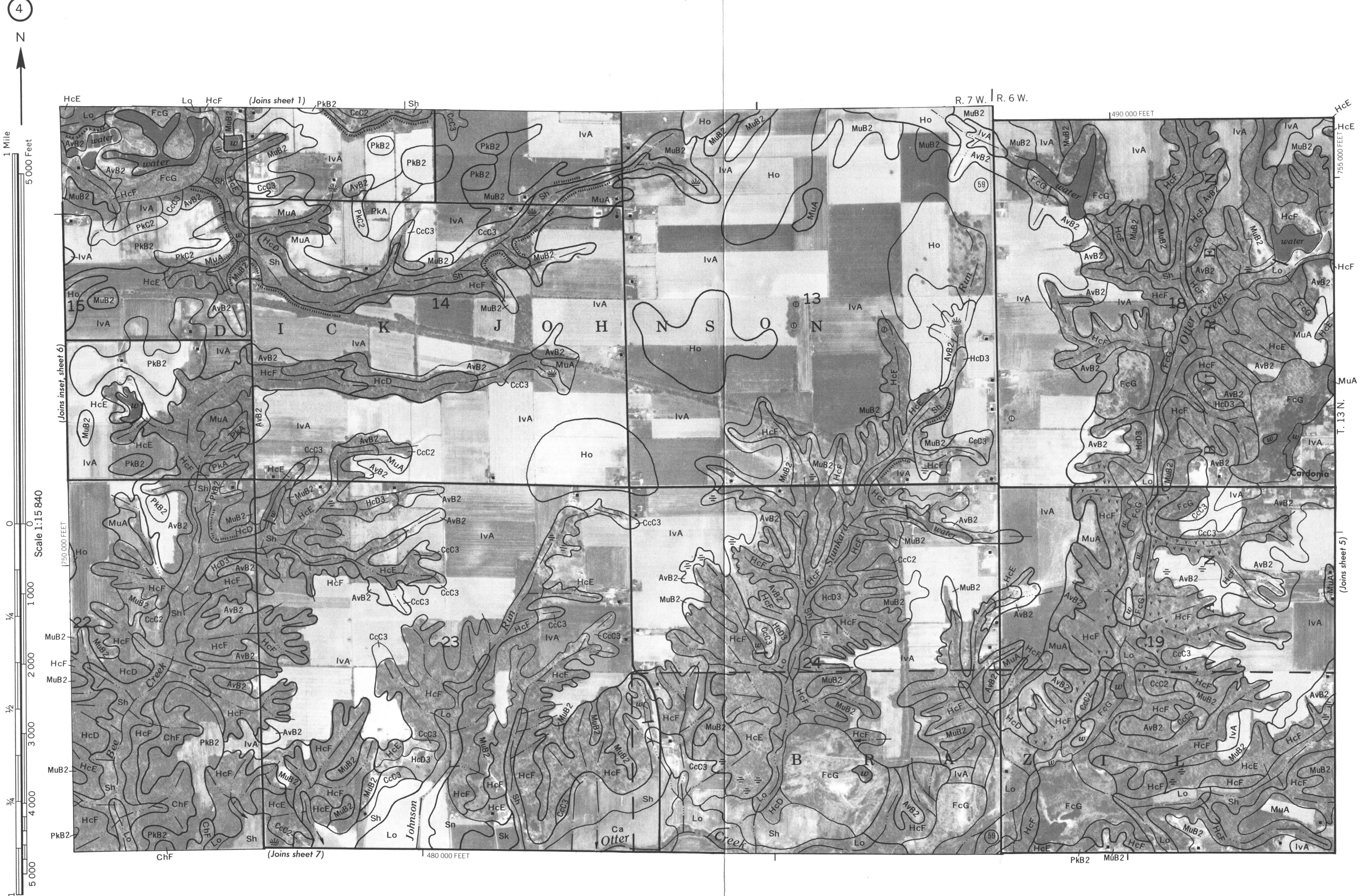
CLAY COUNTY, INDIANA NO. 3



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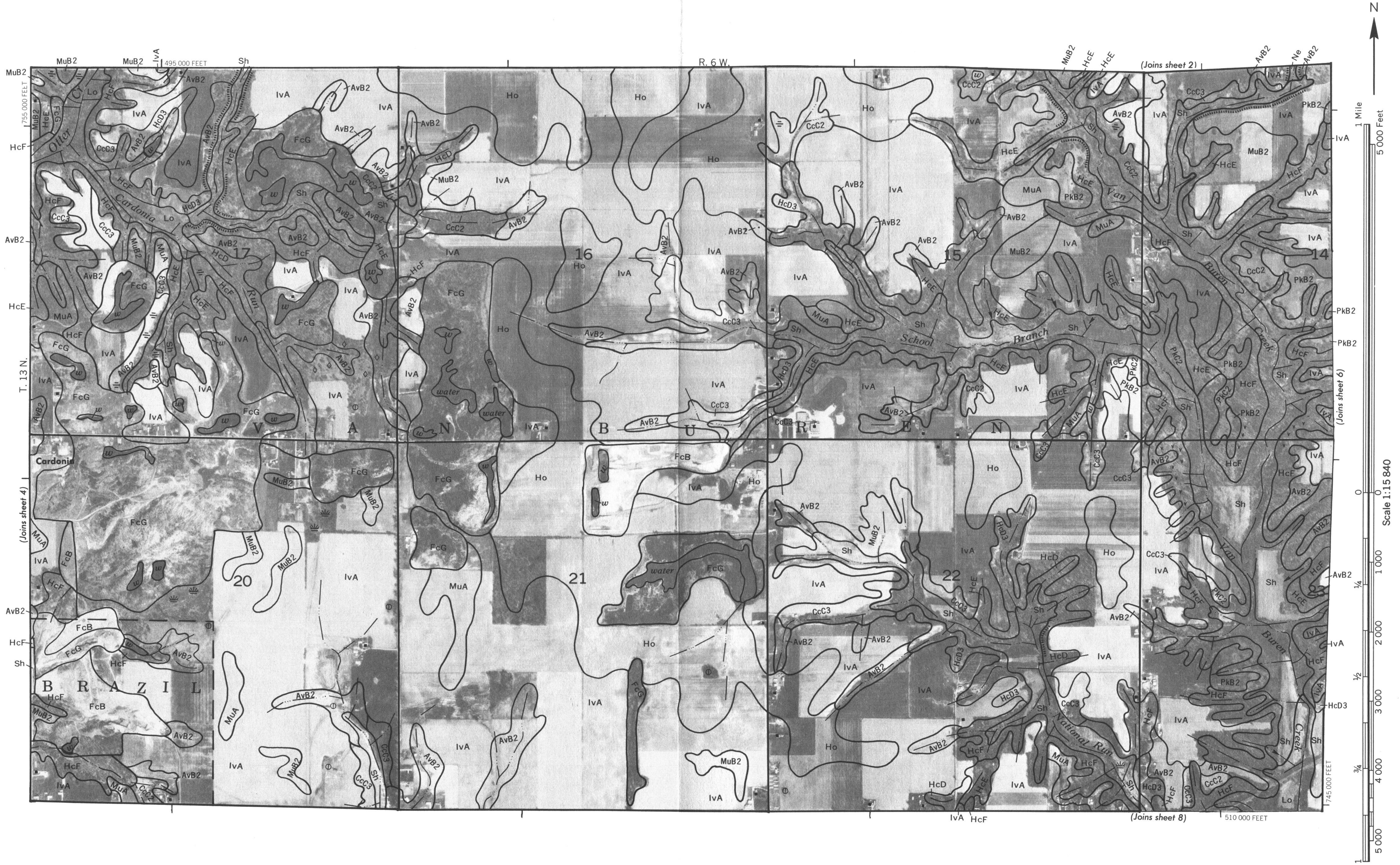
5



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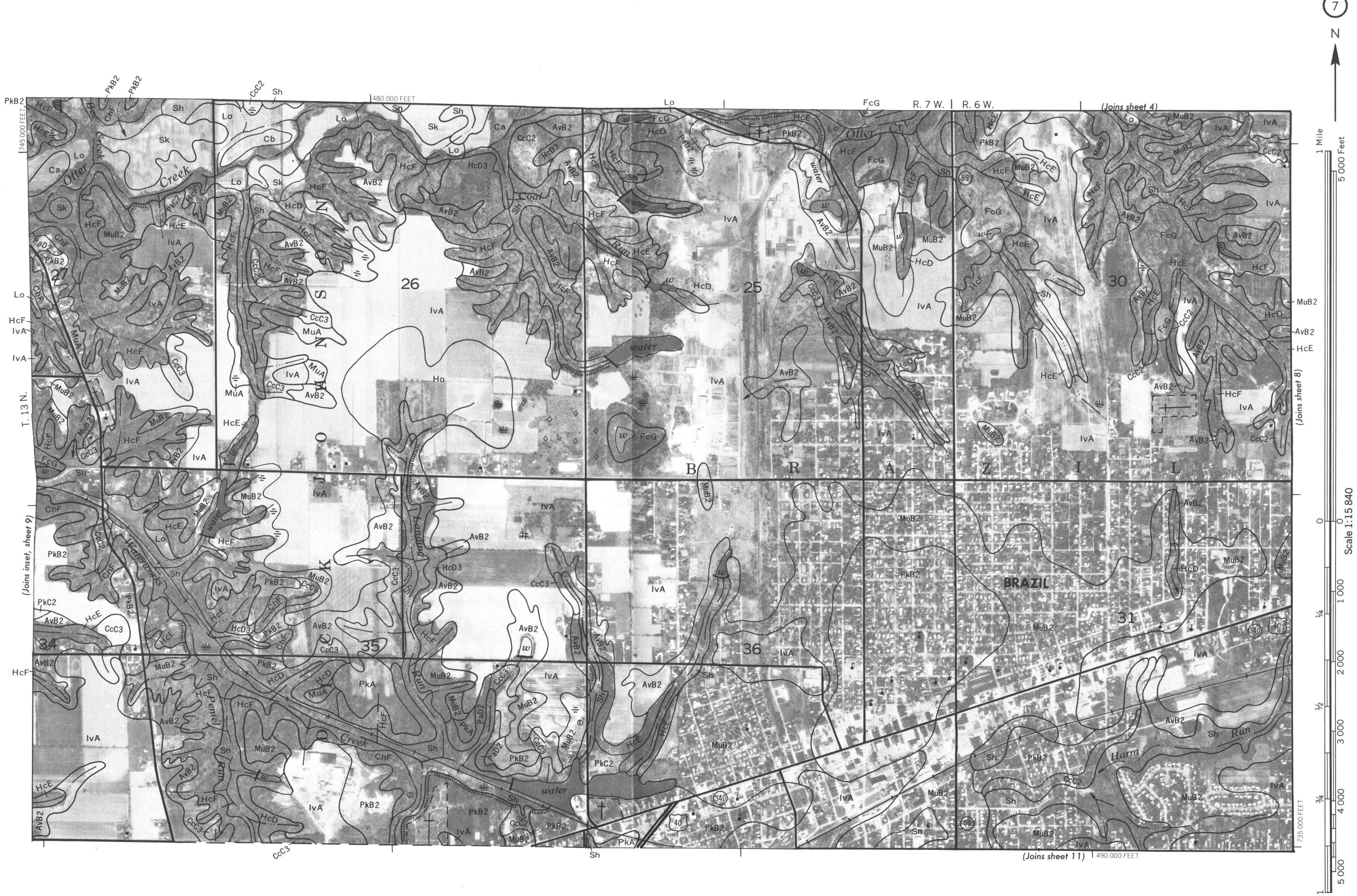

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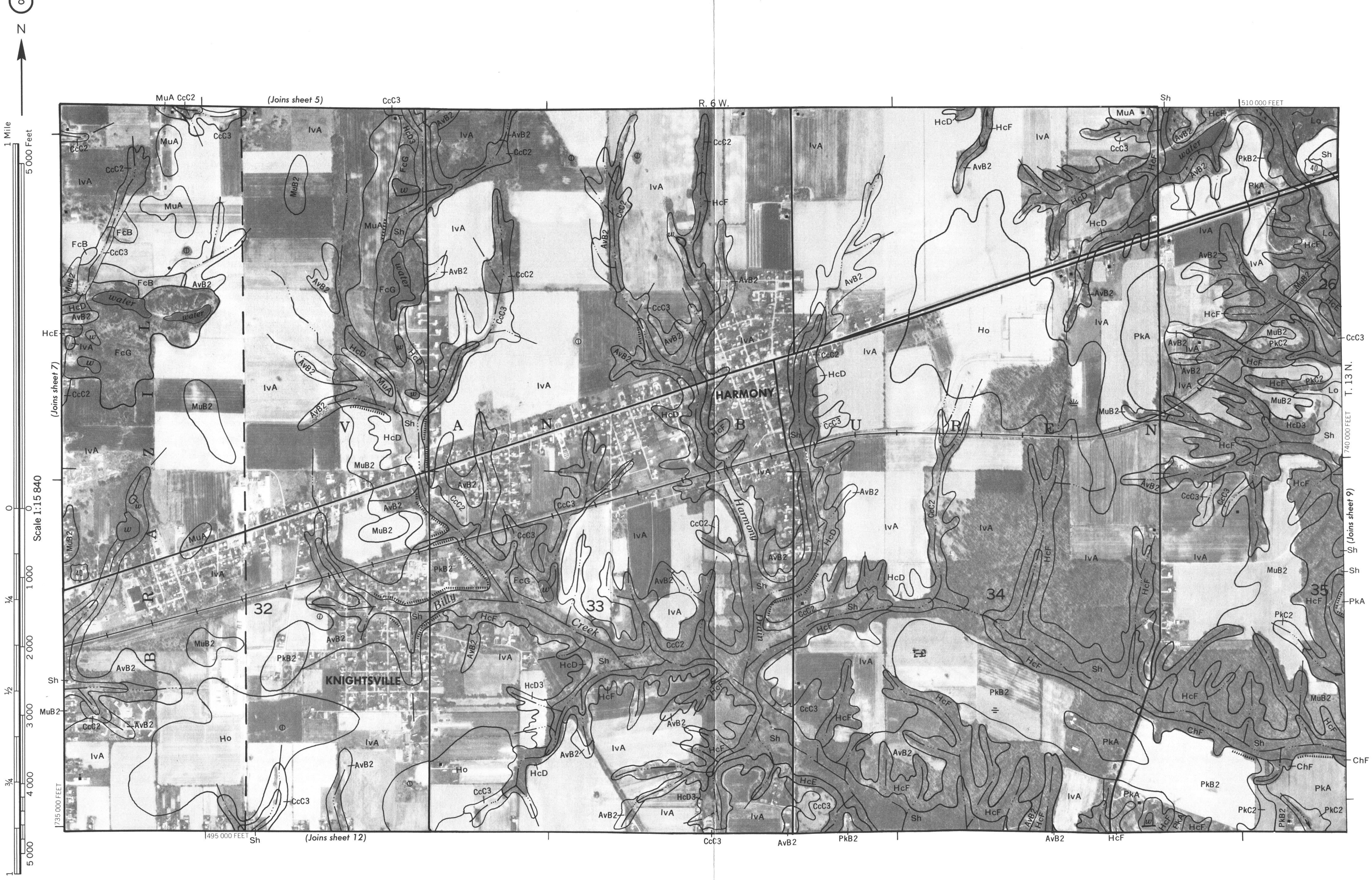

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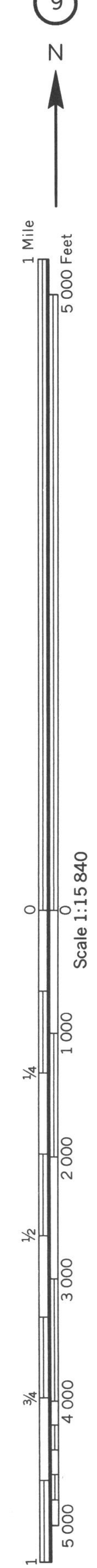

4000 AND 5000-FOOT GRID TICKS

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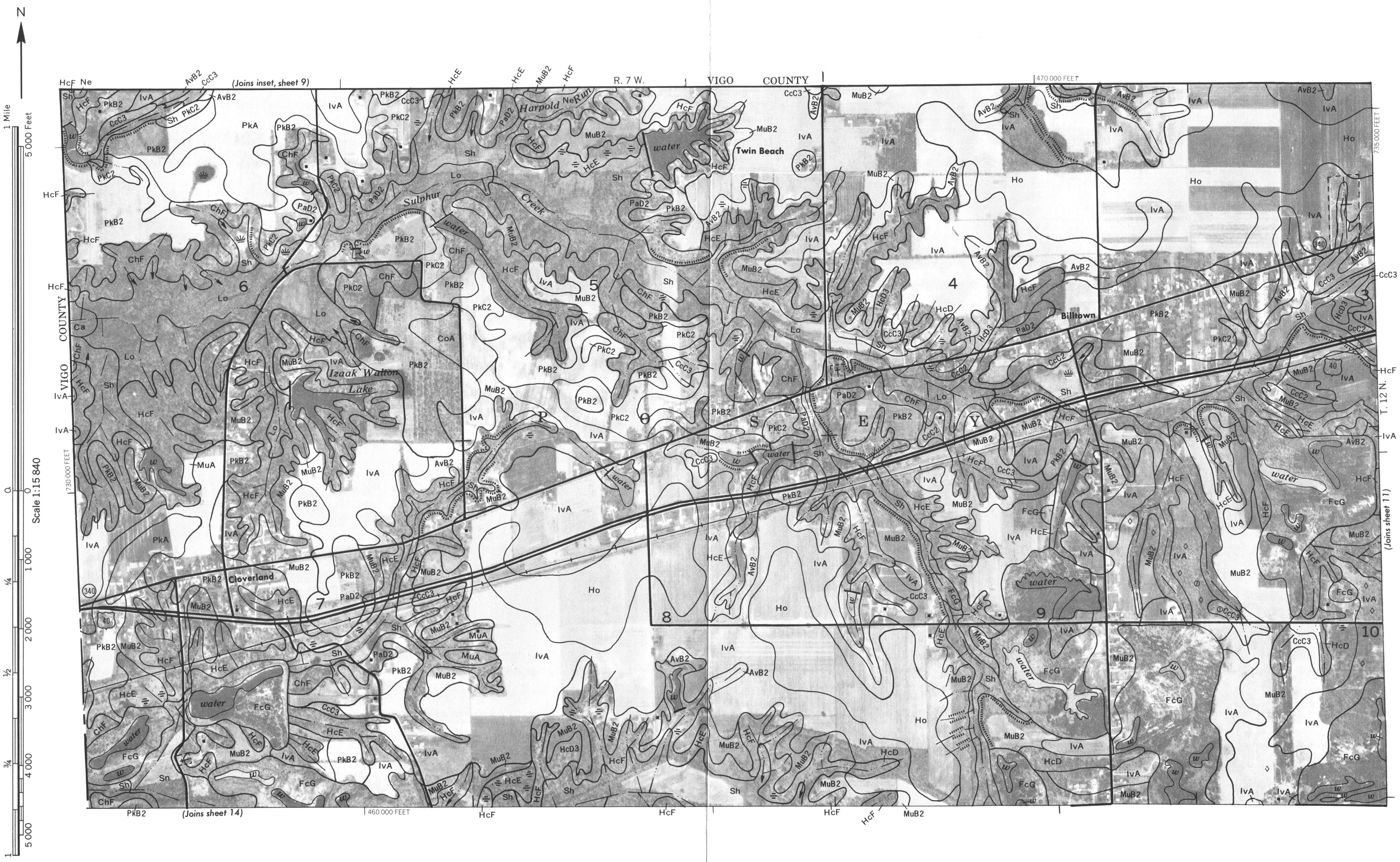

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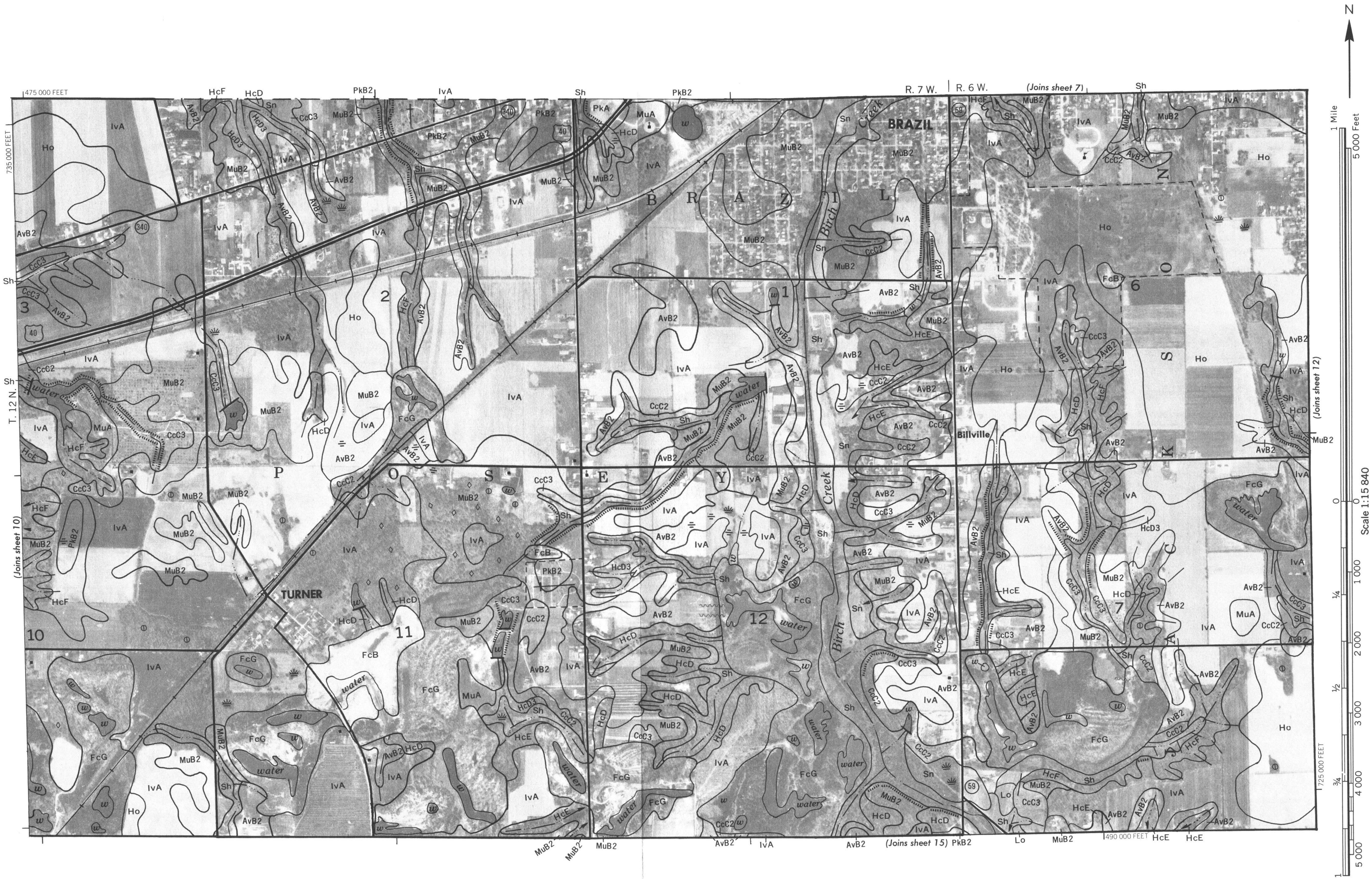

CLAY COUNTY, INDIANA NO. 11

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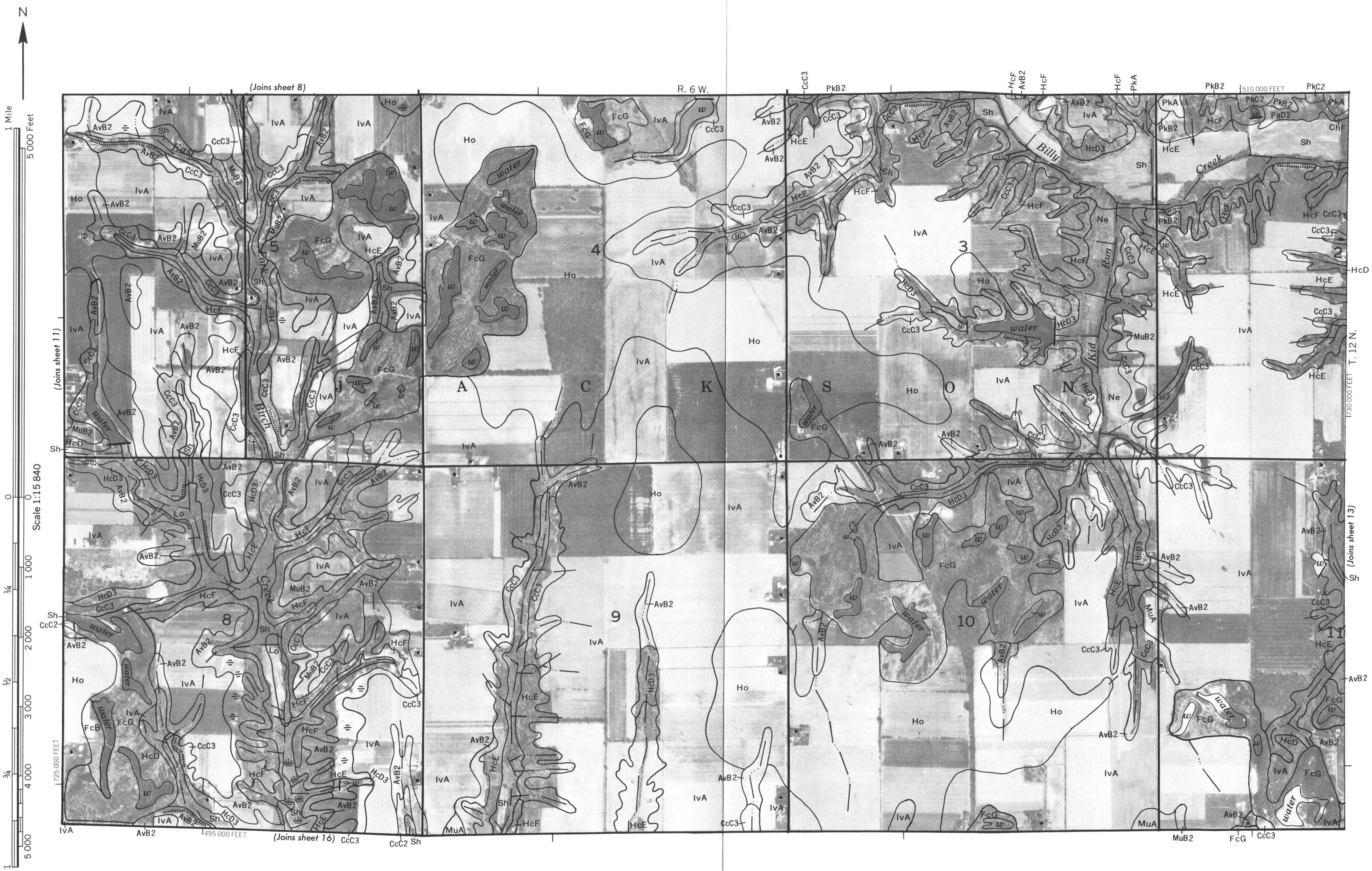
CLAY COUNTY, INDIANA — SHEET NUMBER 12



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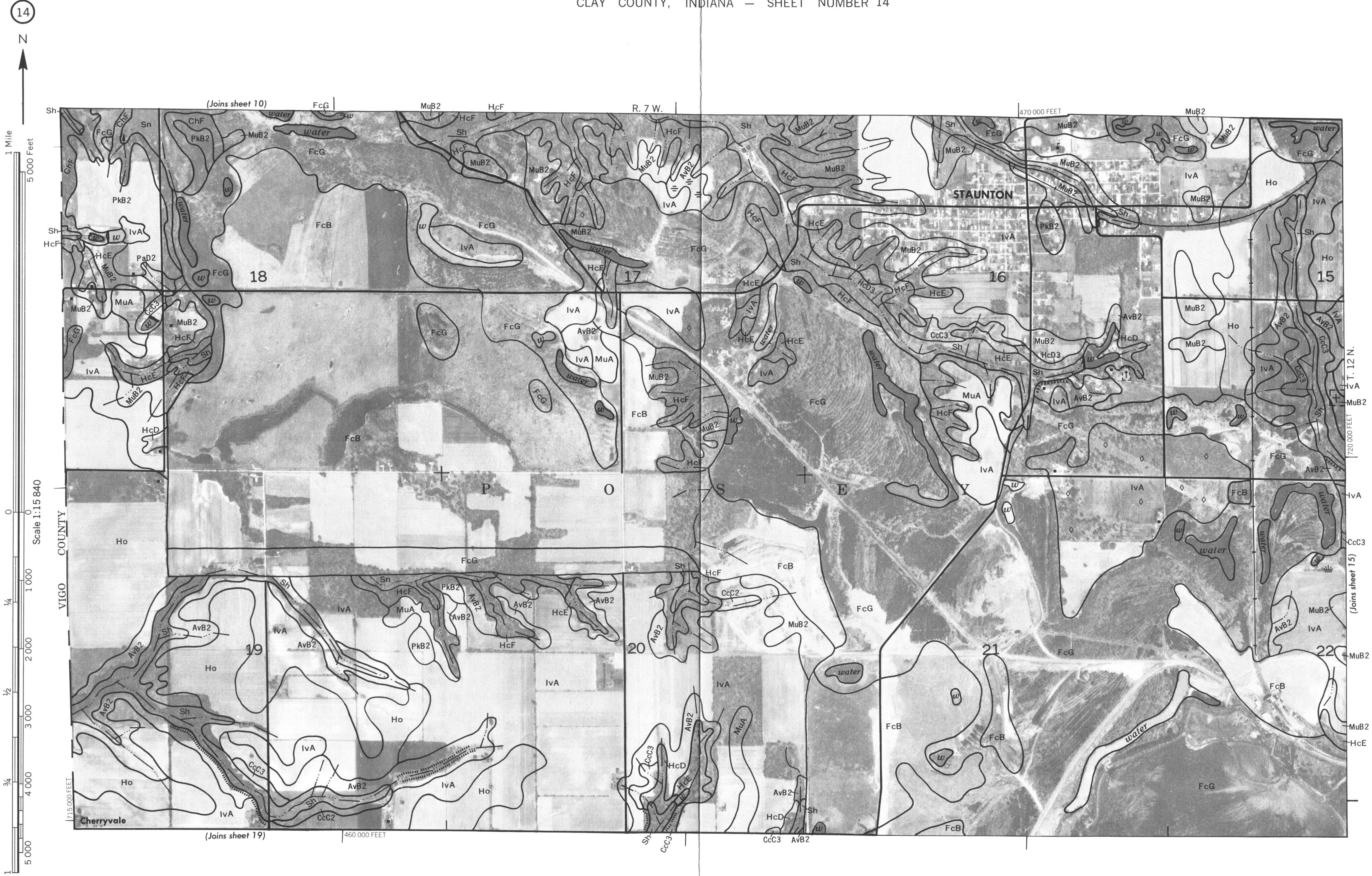
CLAY COUNTY, INDIANA NO. 12

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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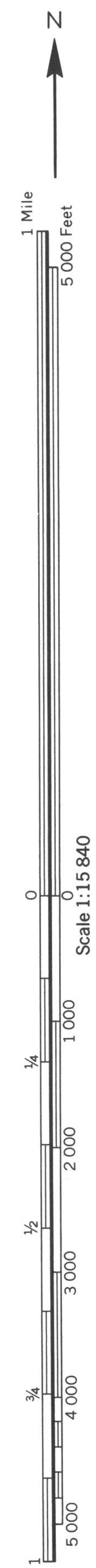

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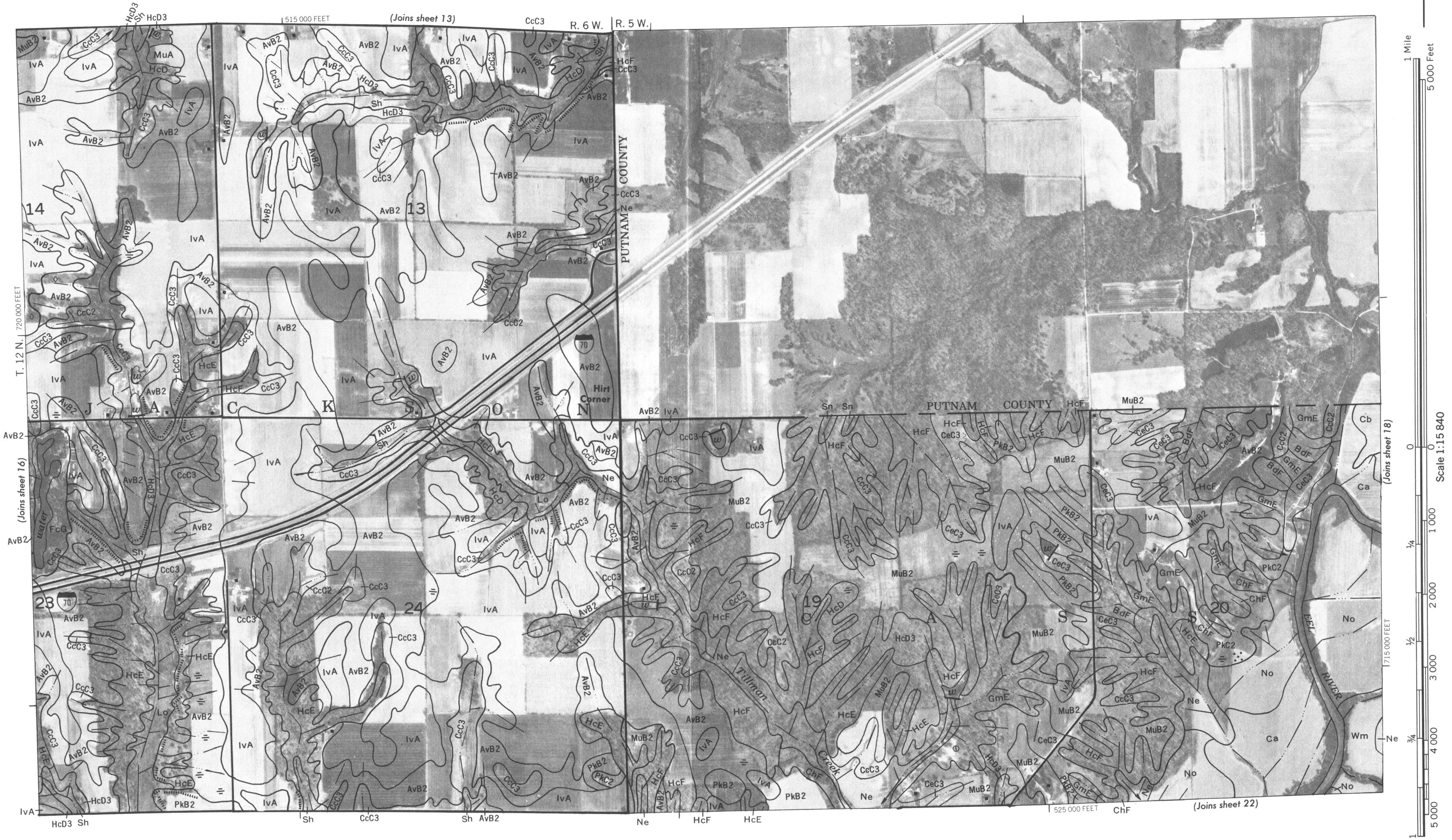
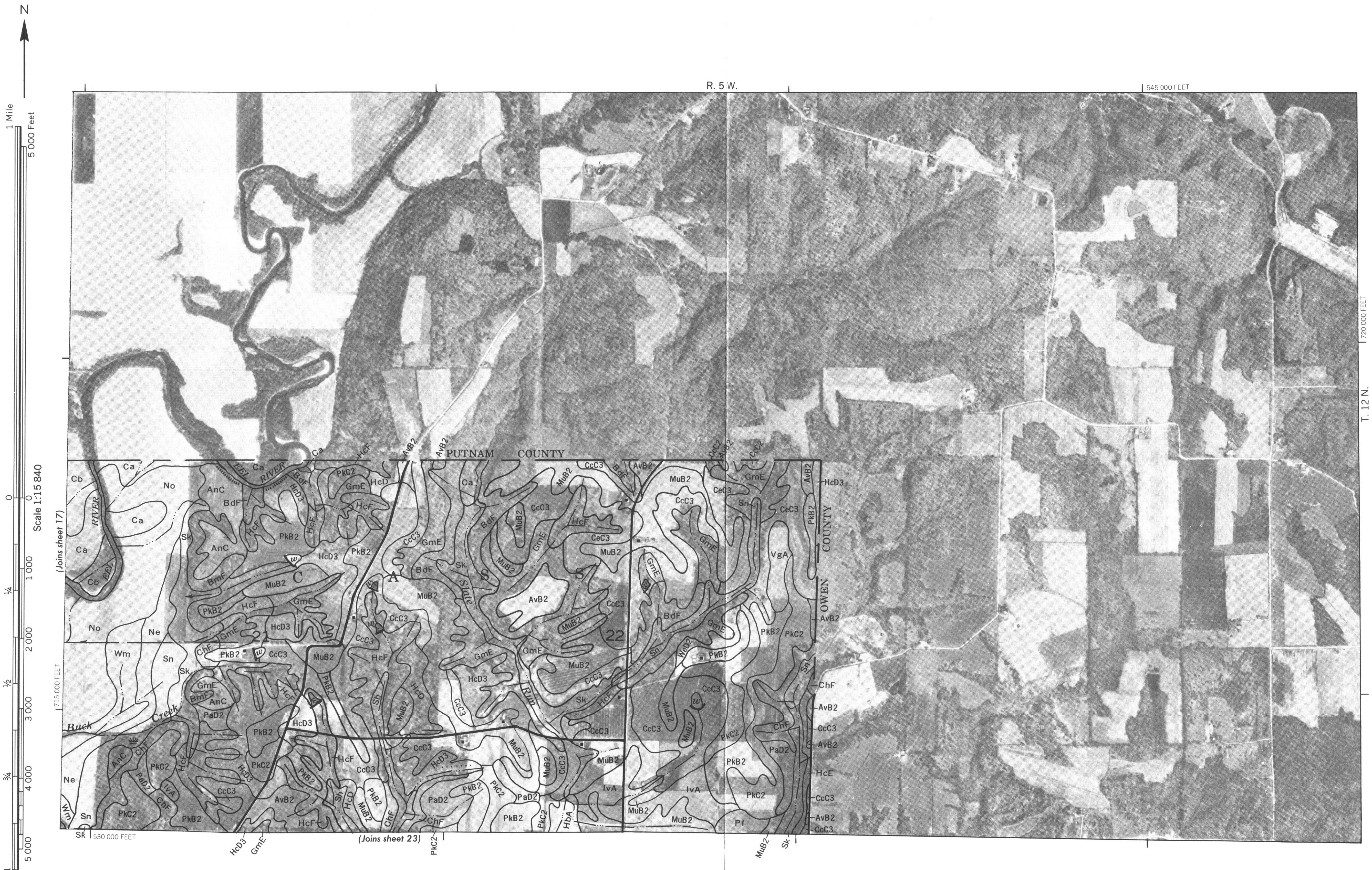
CLAY COUNTY, INDIANA — SHEET NUMBER 16

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 16



CLAY COUNTY, INDIANA NO. 17
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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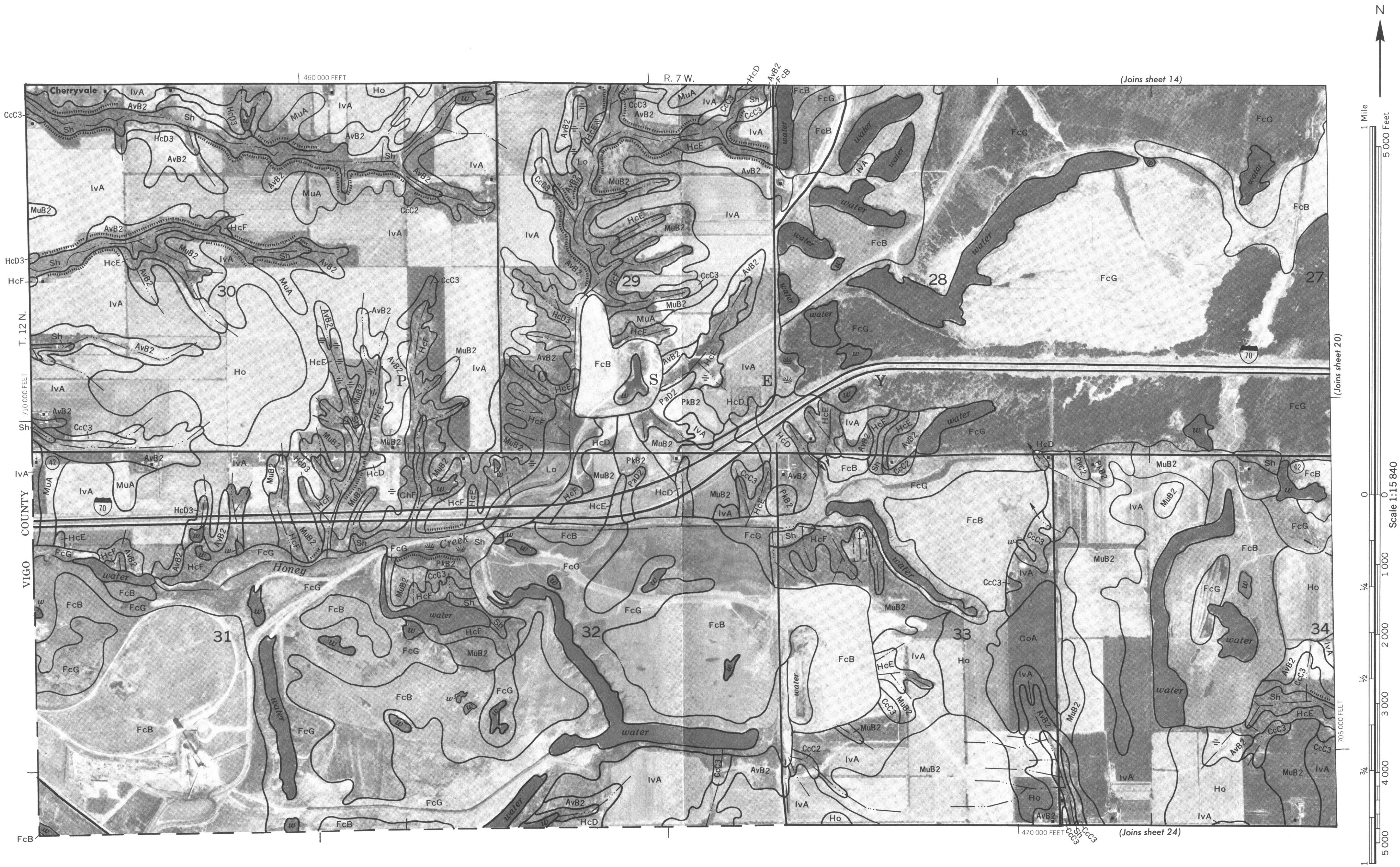

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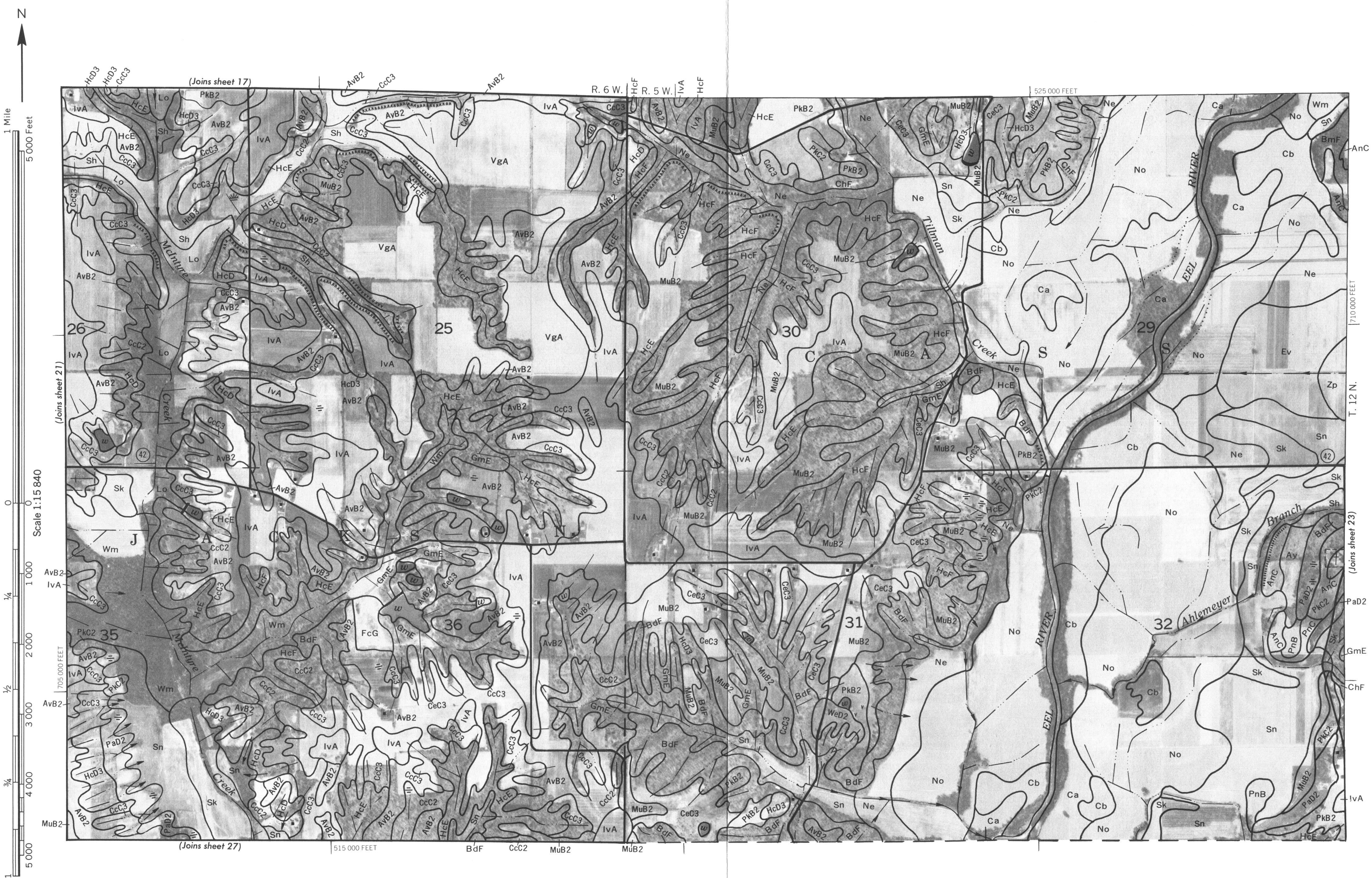
CLAY COUNTY, INDIANA NO. 21

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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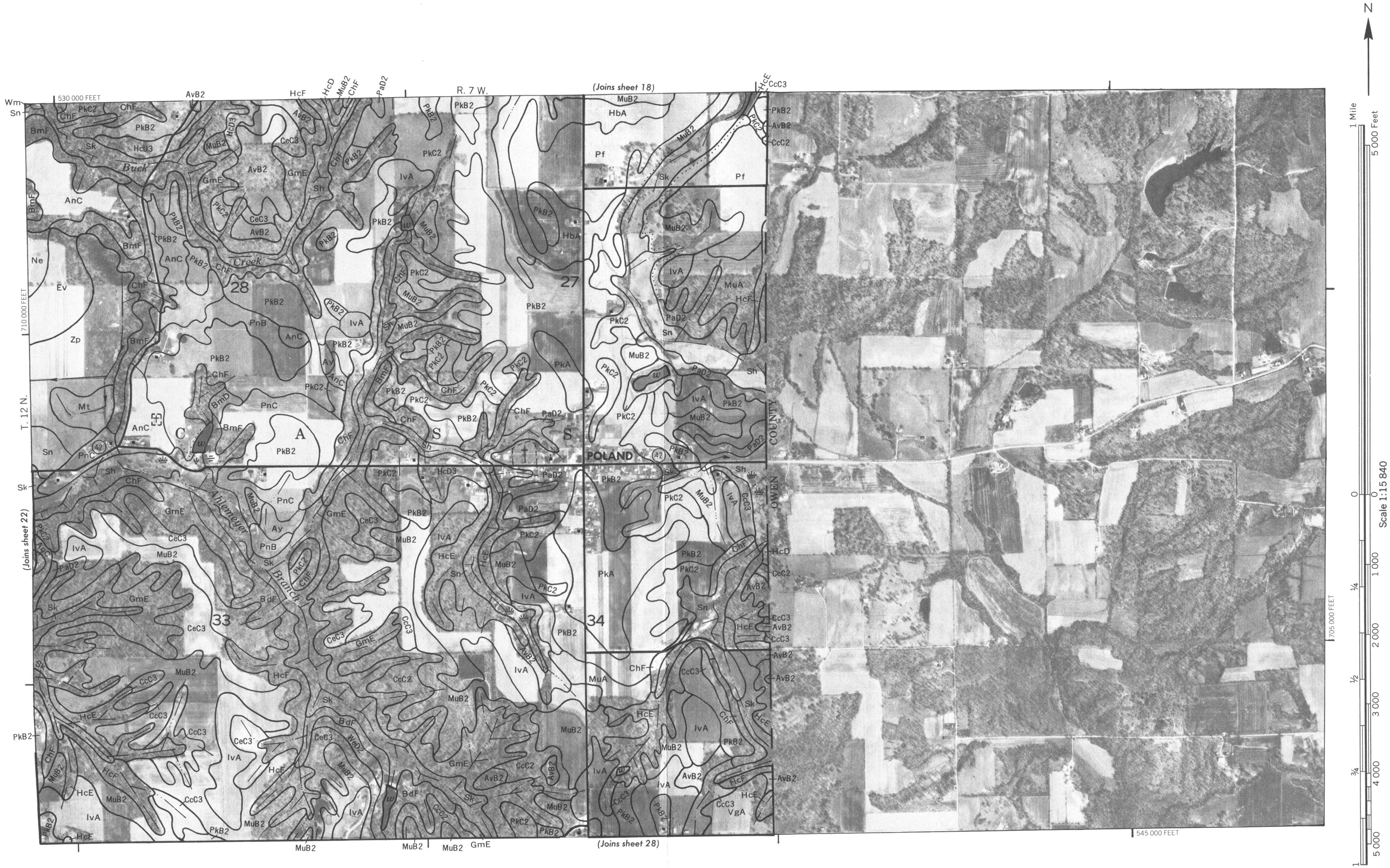
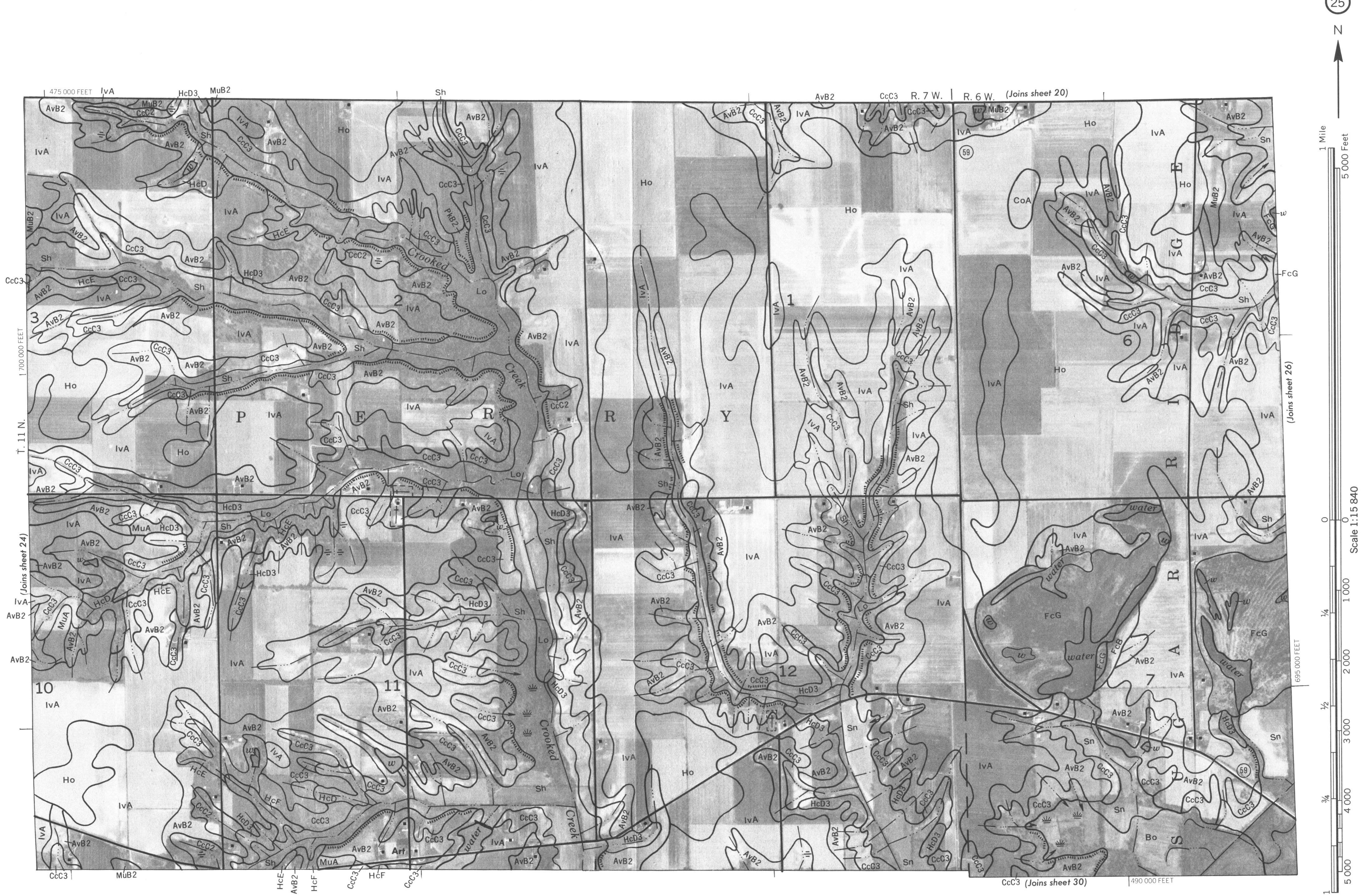


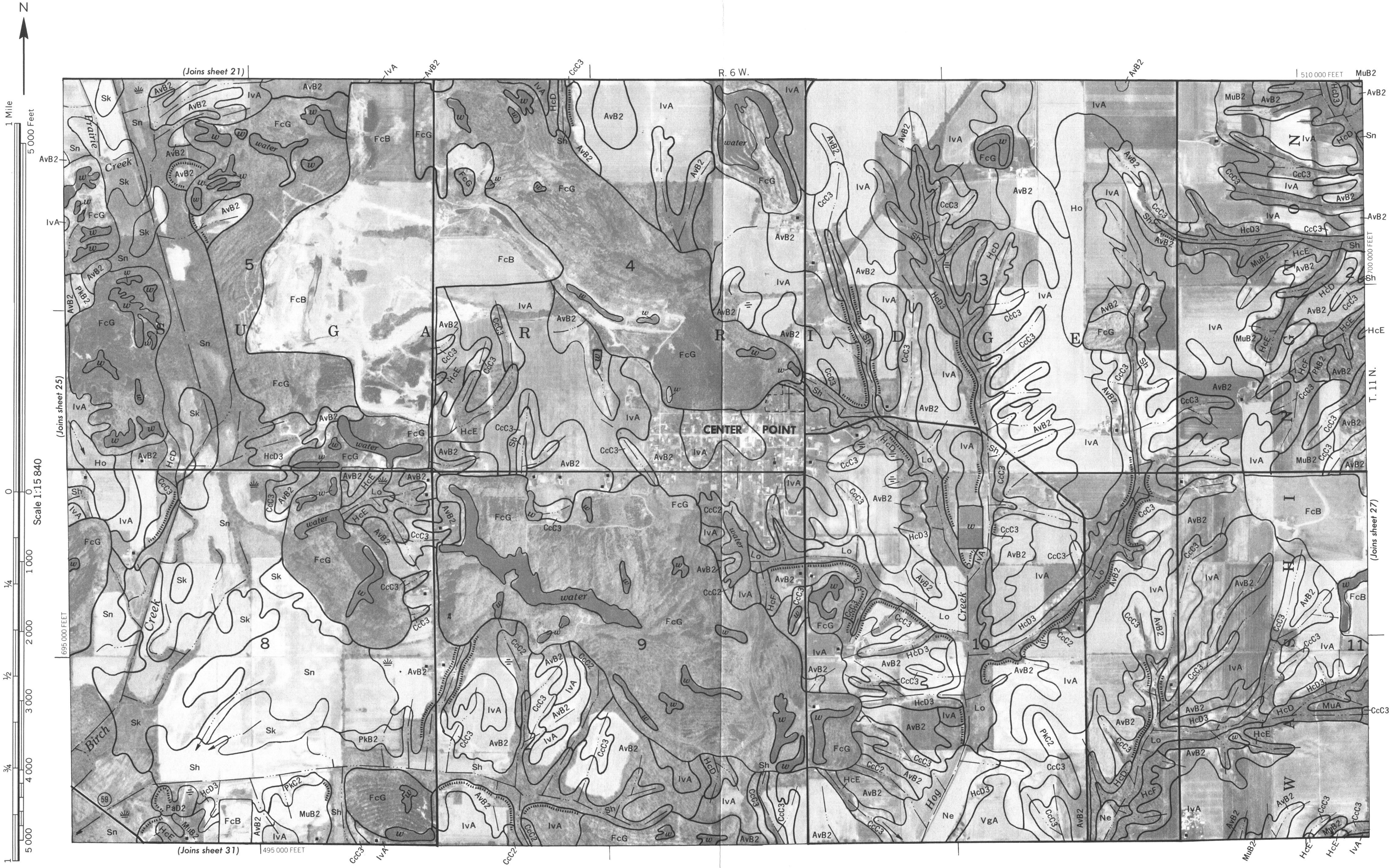
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



CLAY COUNTY, INDIANA NO. 25

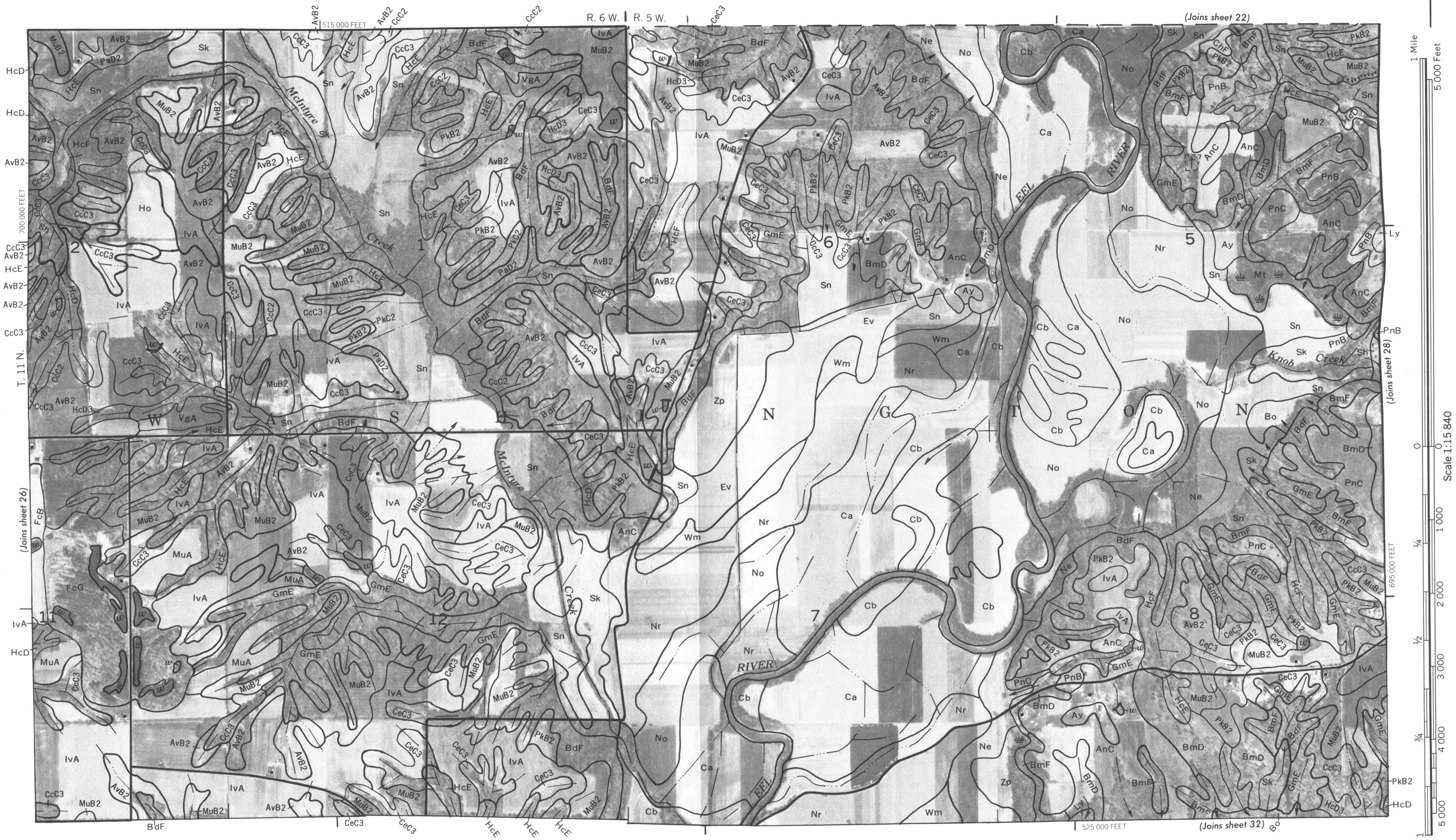
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA — SHEET NUMBER 26



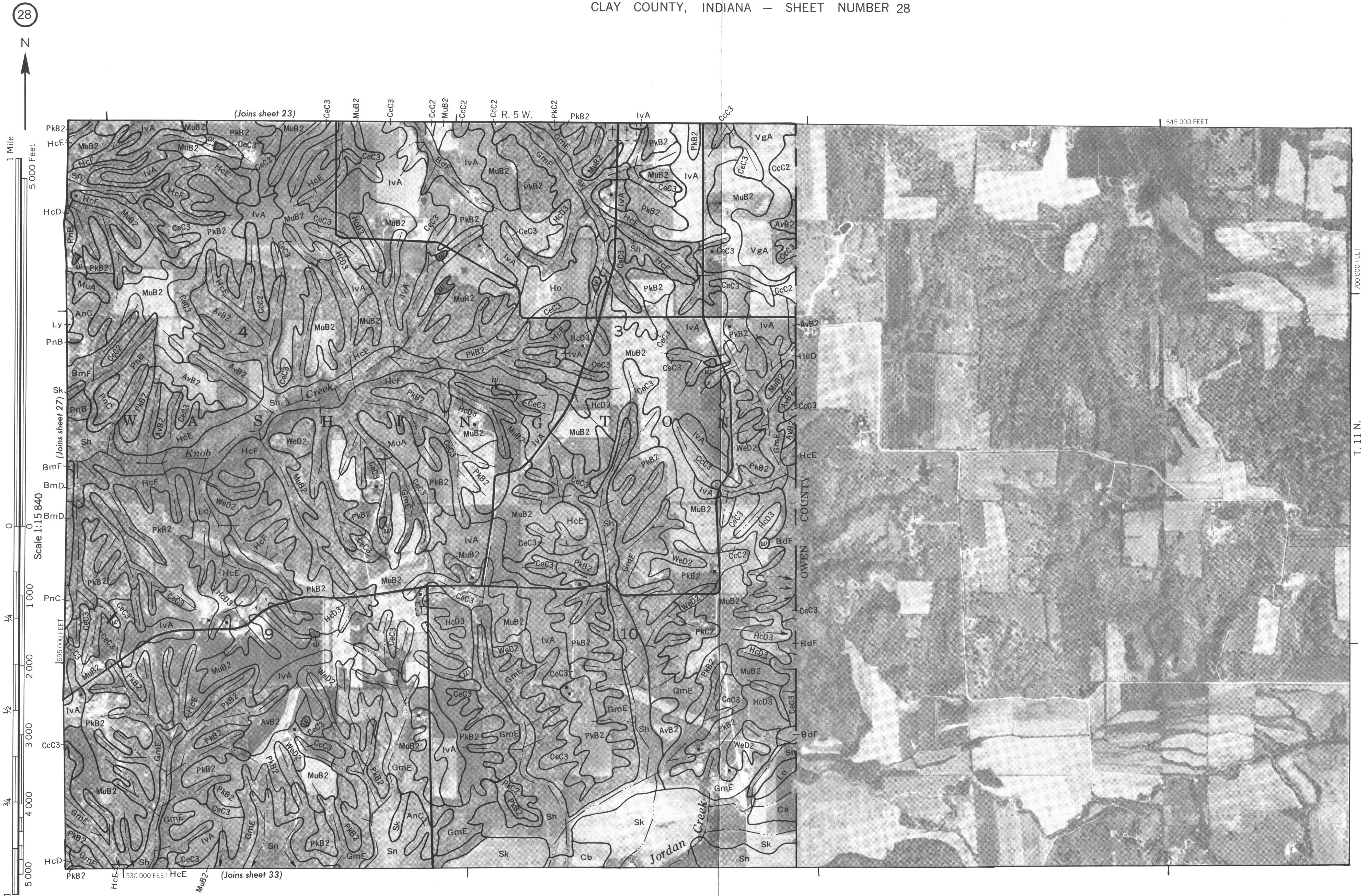
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 26



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 27



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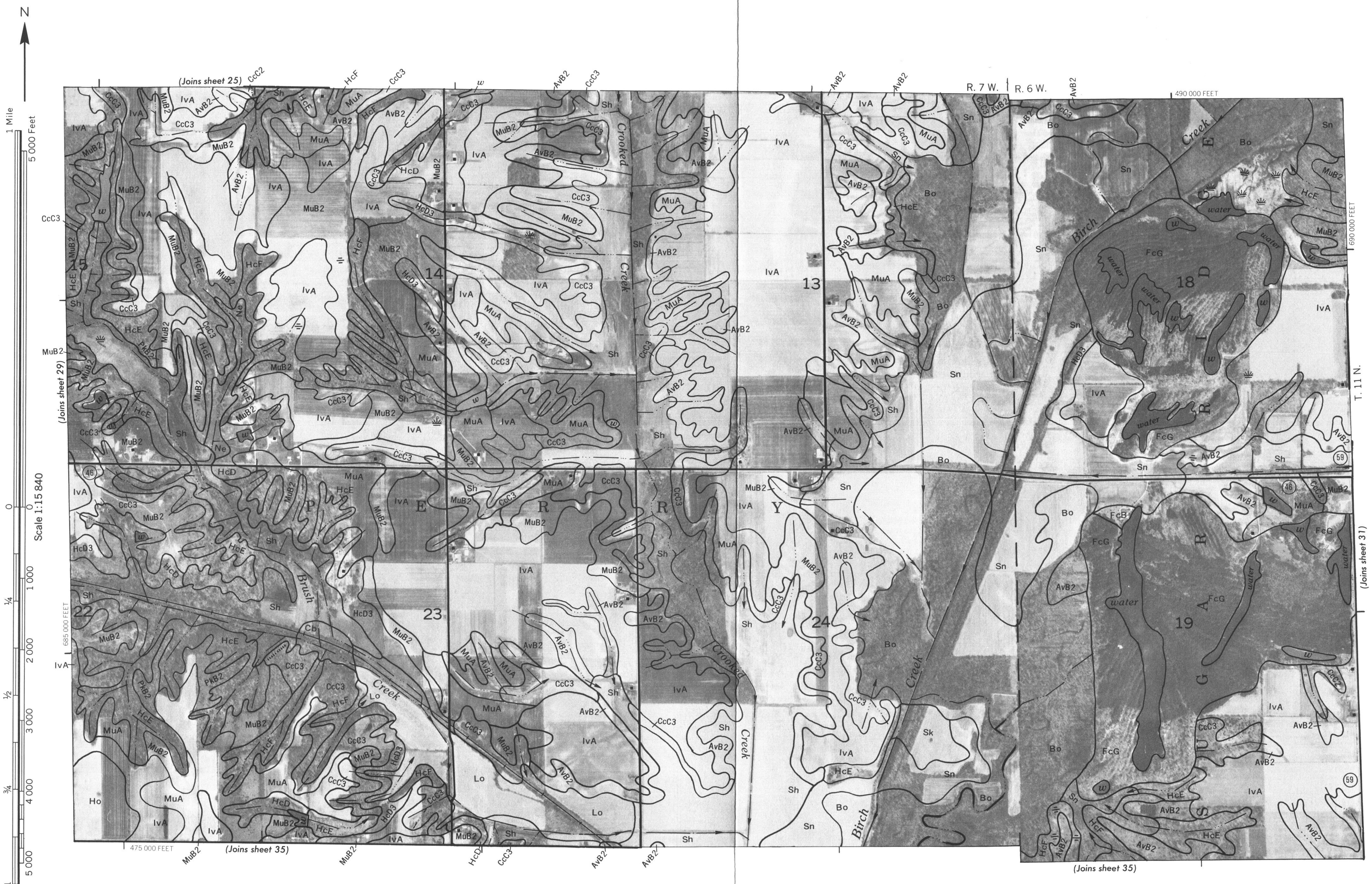
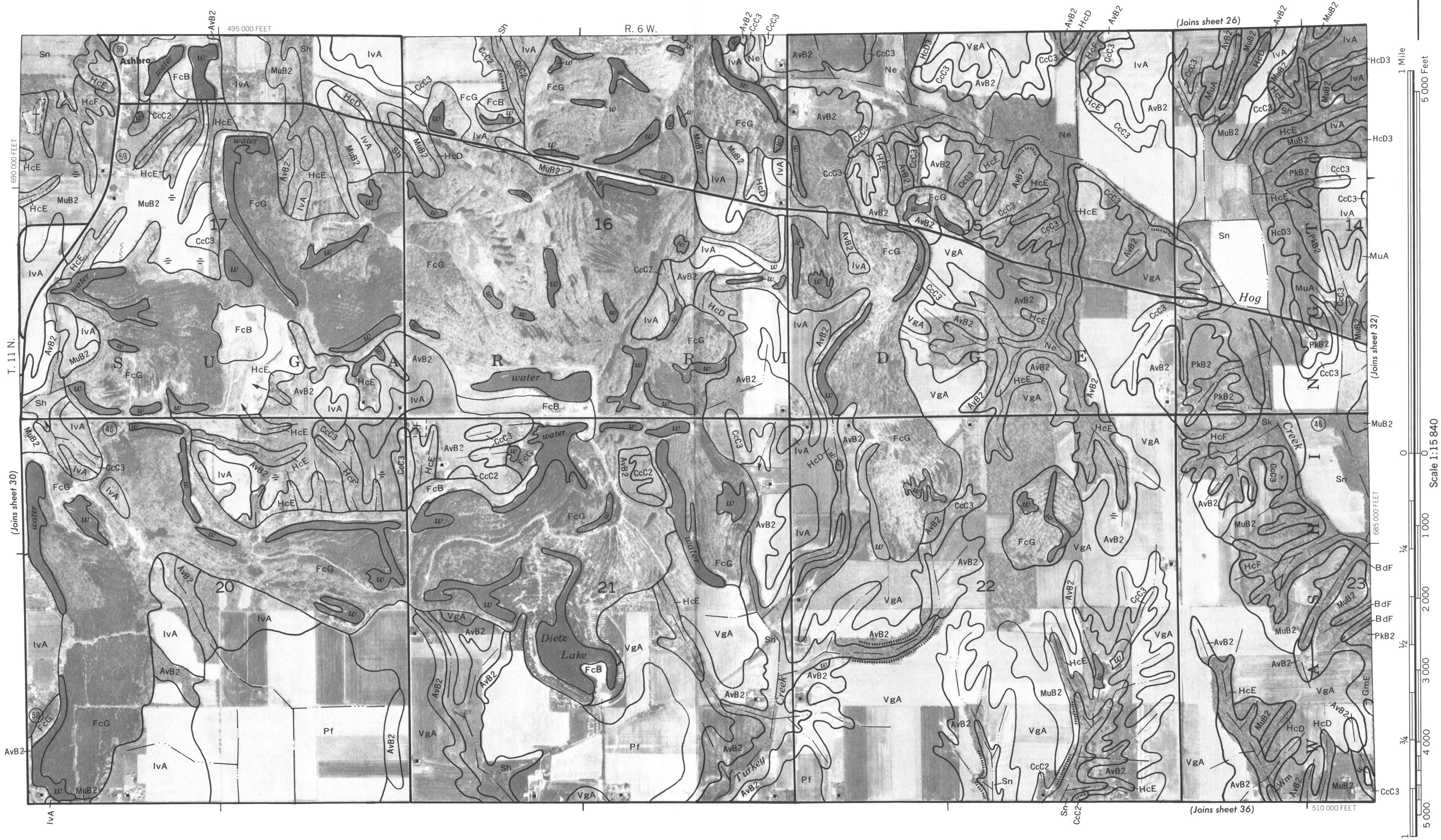


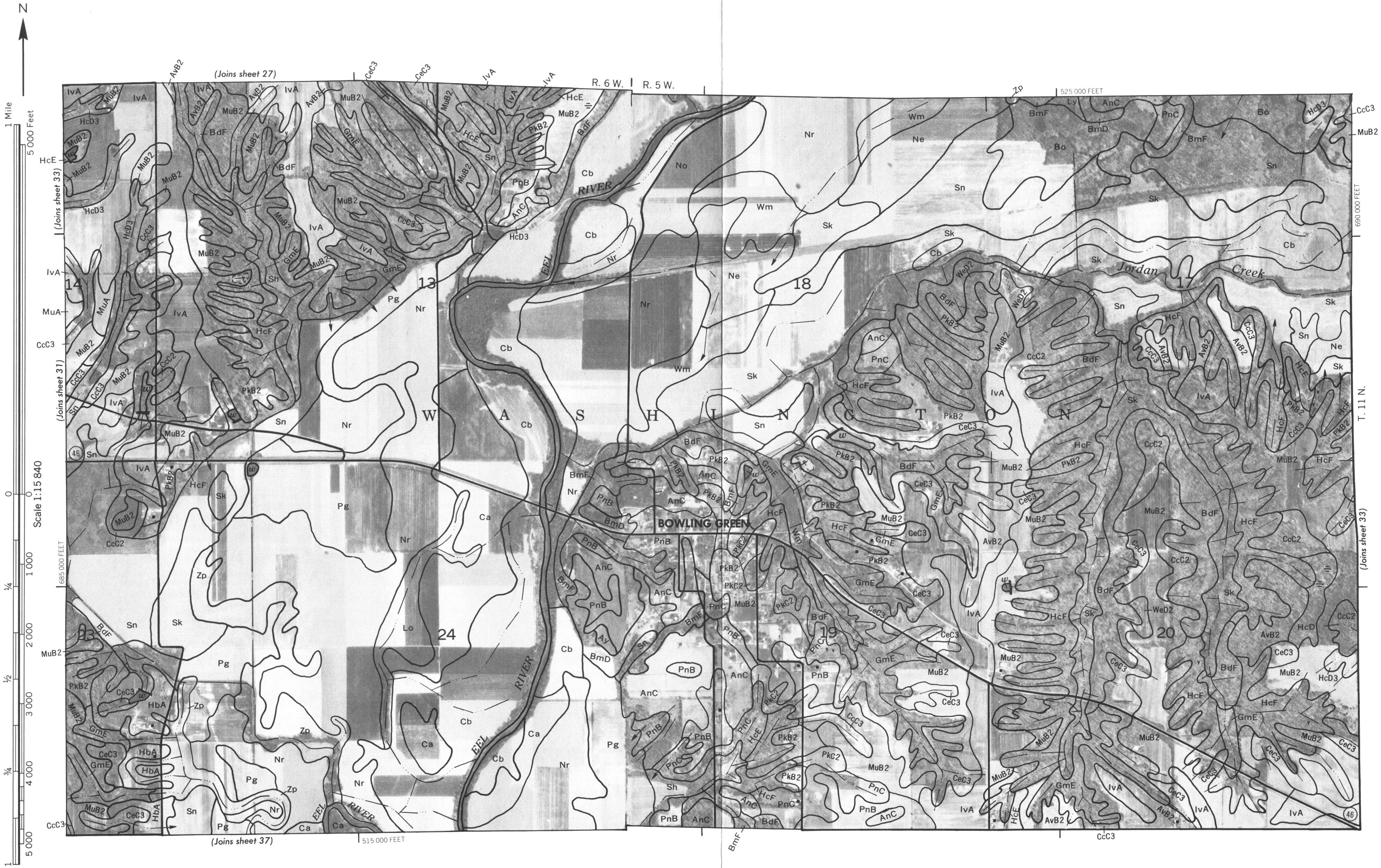
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 30



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 31



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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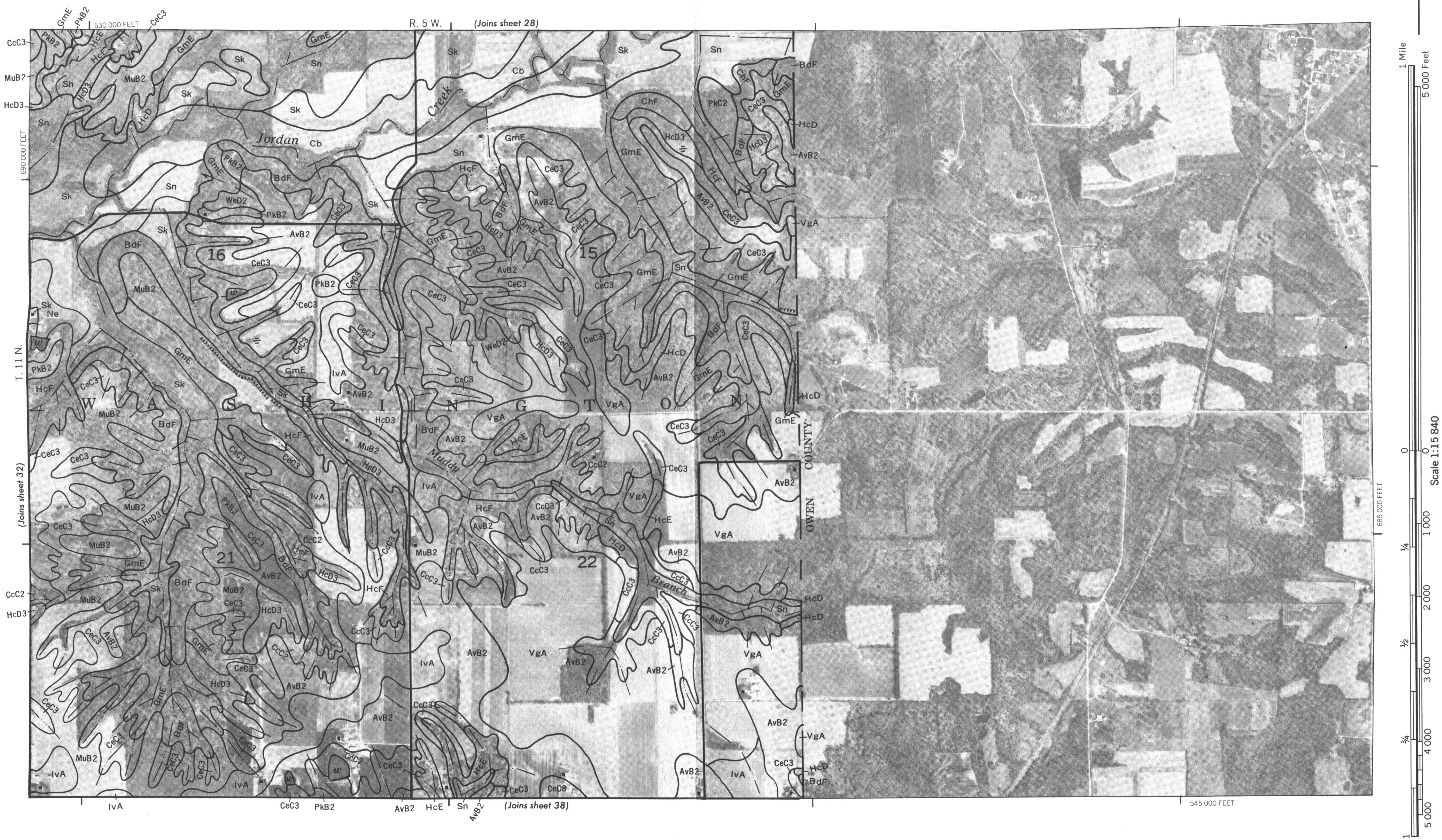

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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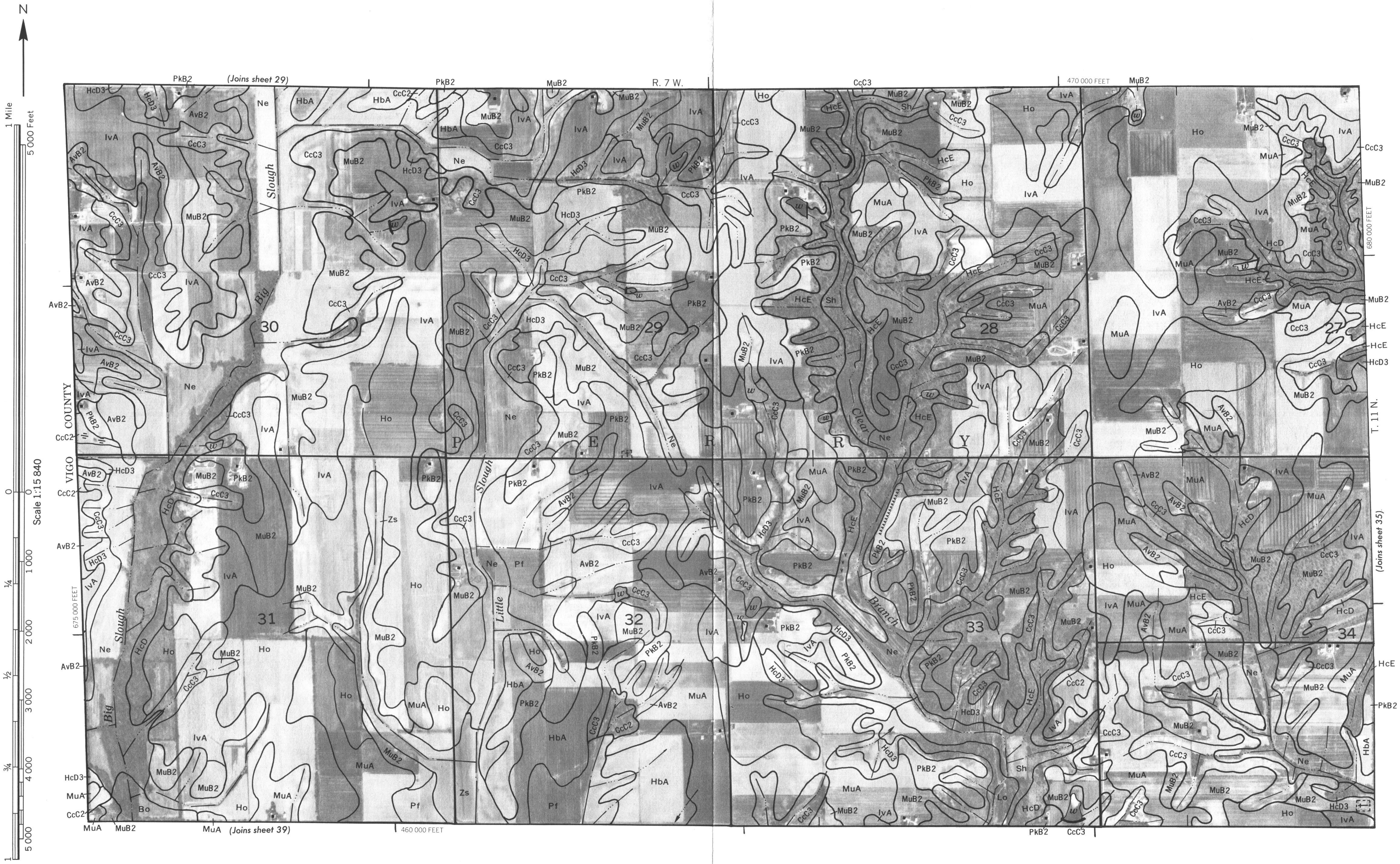

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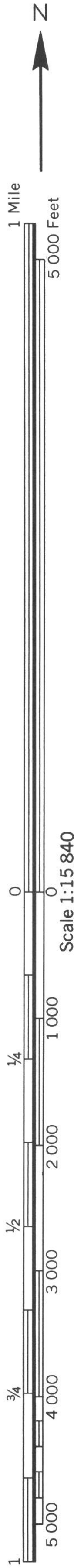
CLAY COUNTY, INDIANA NO. 35
This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA — SHEET NUMBER 36



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CLAY COUNTY, INDIANA — SHEET NUMBER 40

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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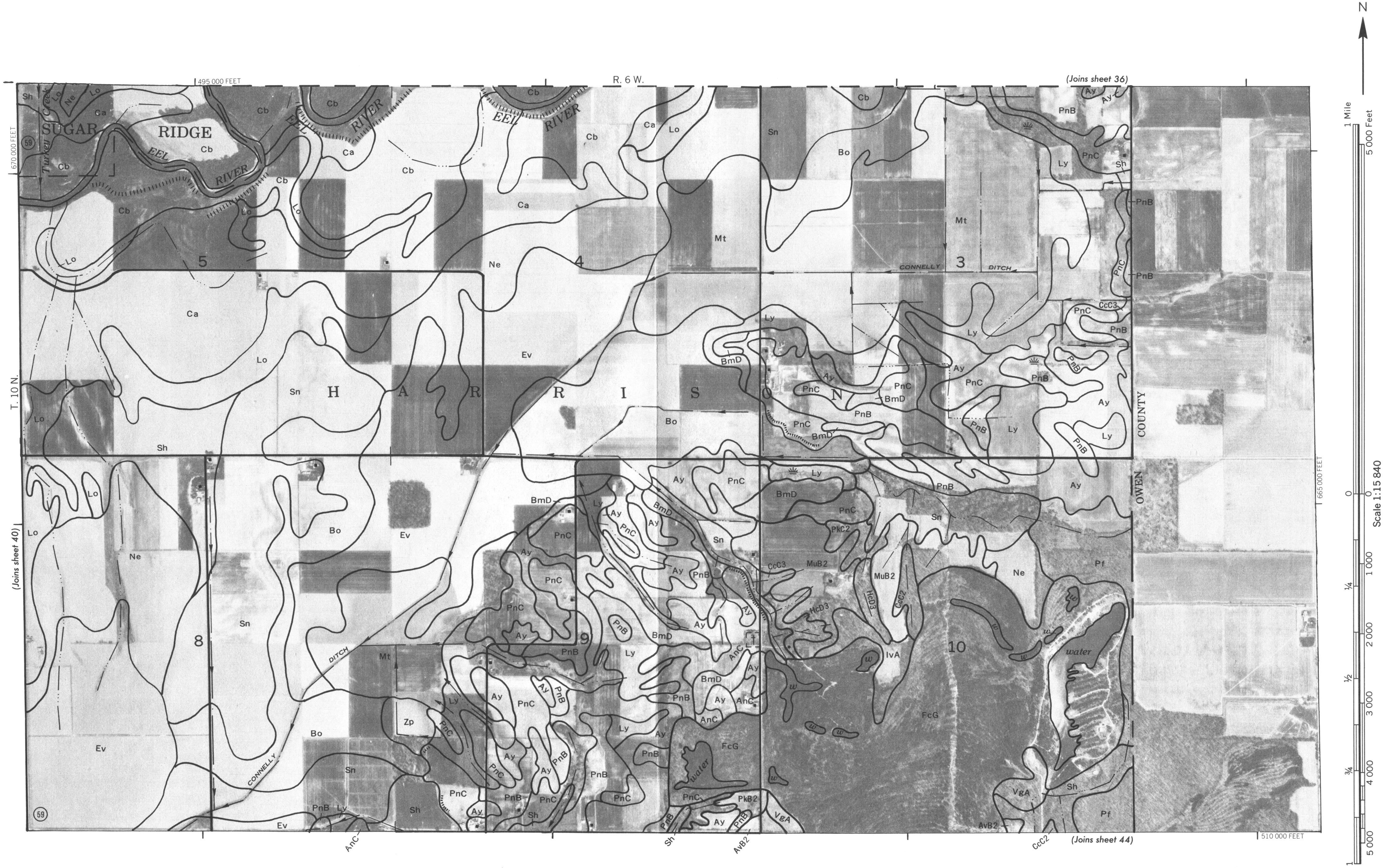
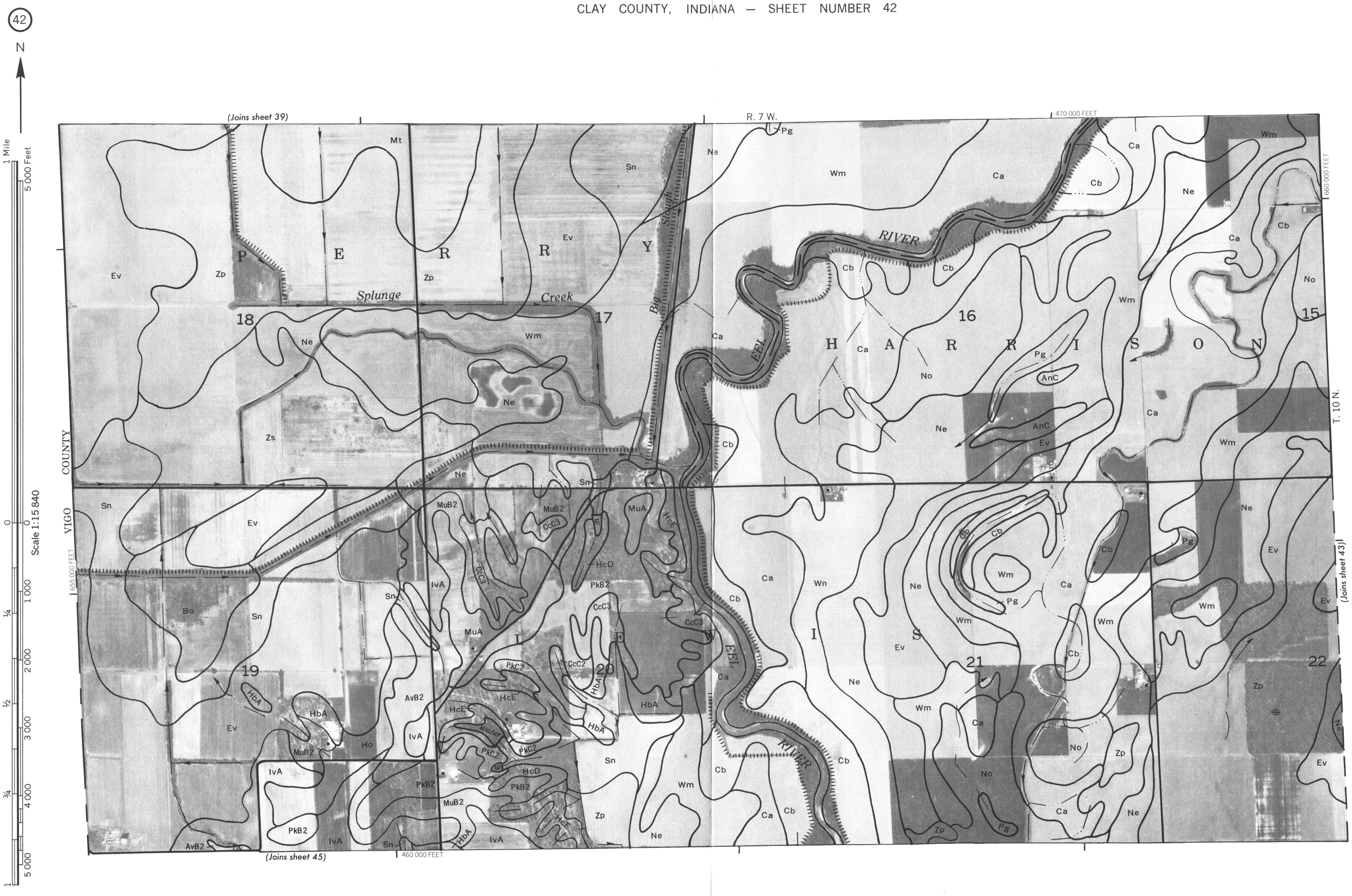
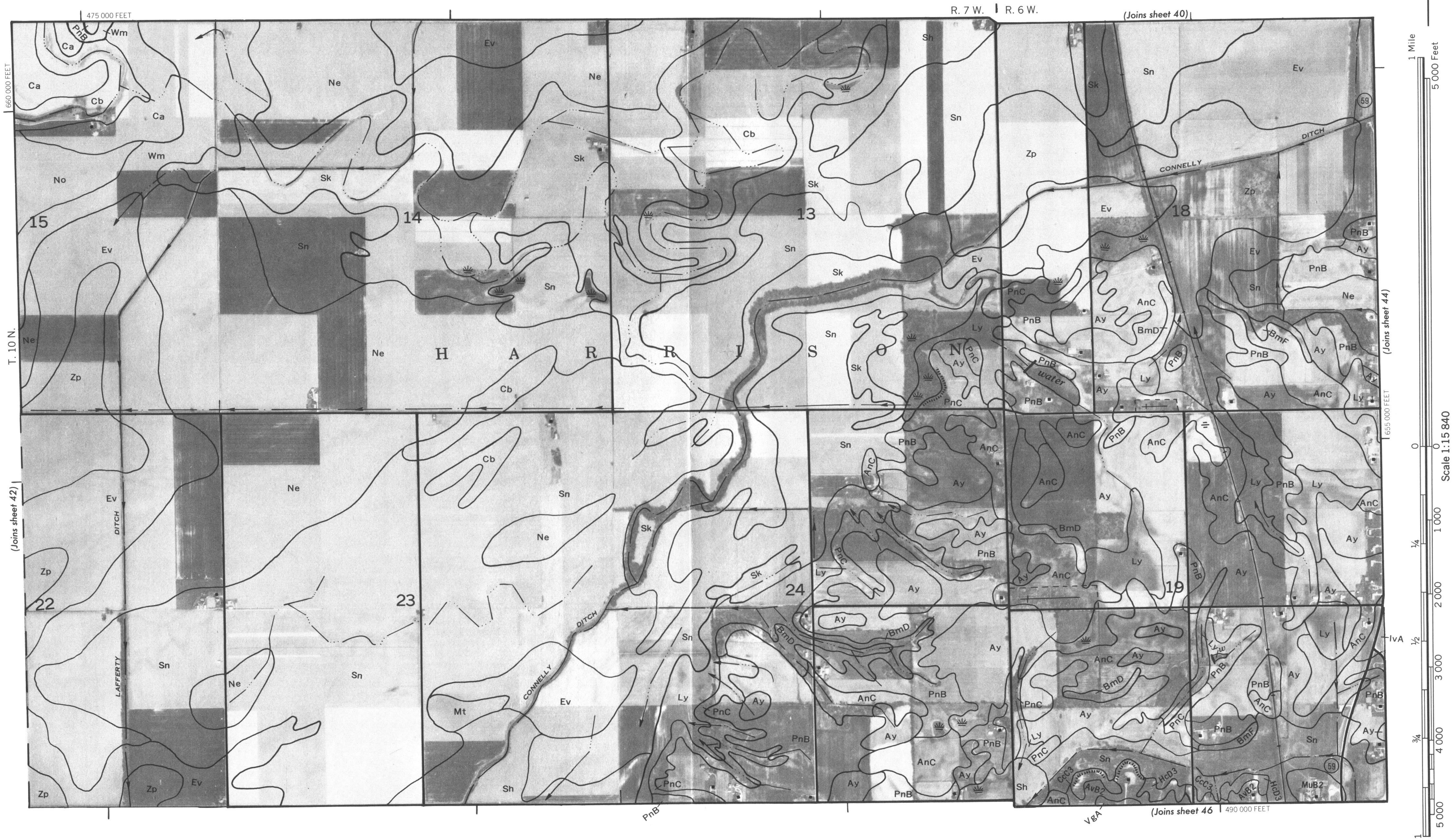


CLAY COUNTY, INDIANA NO. 41

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

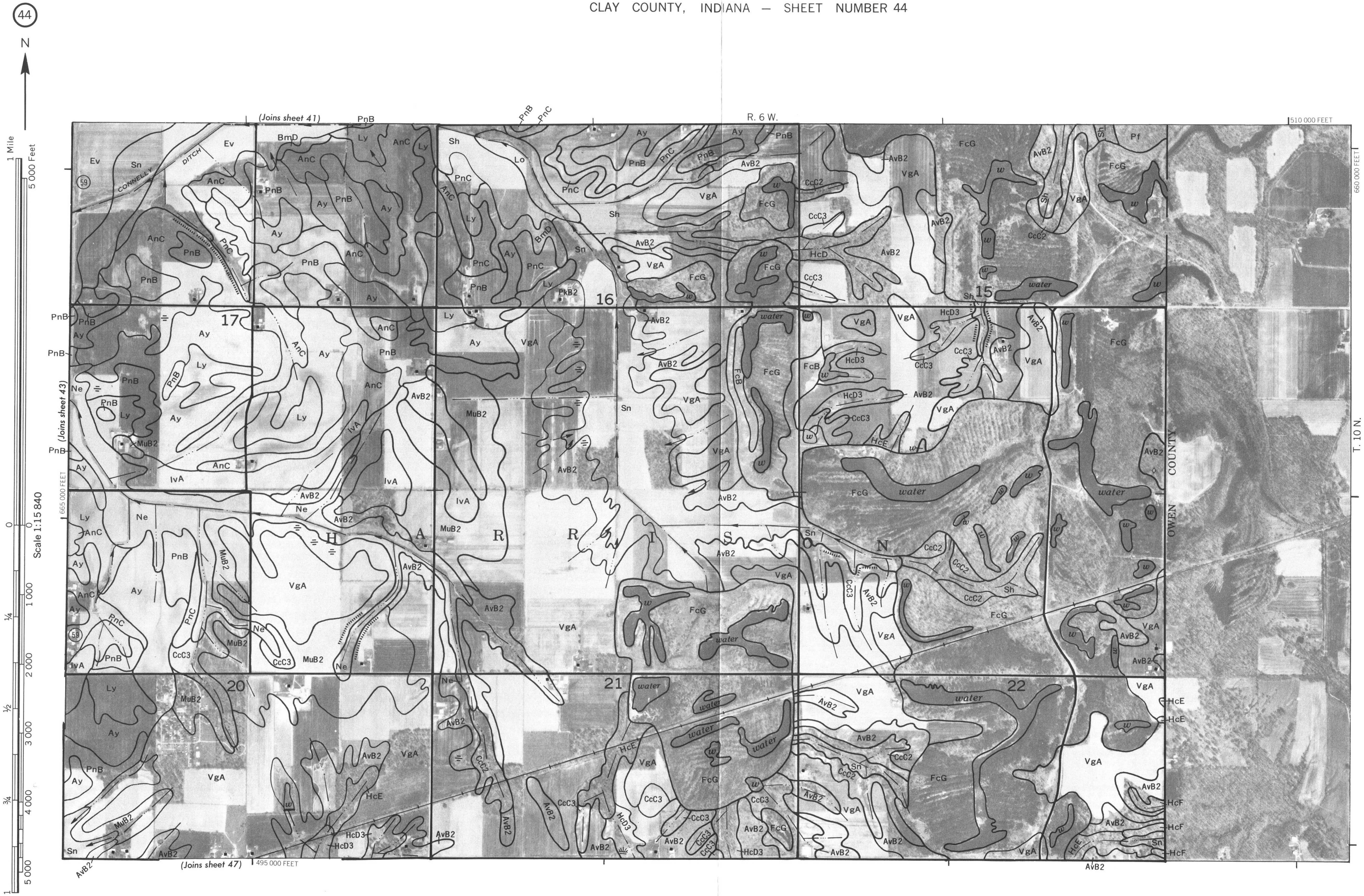


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



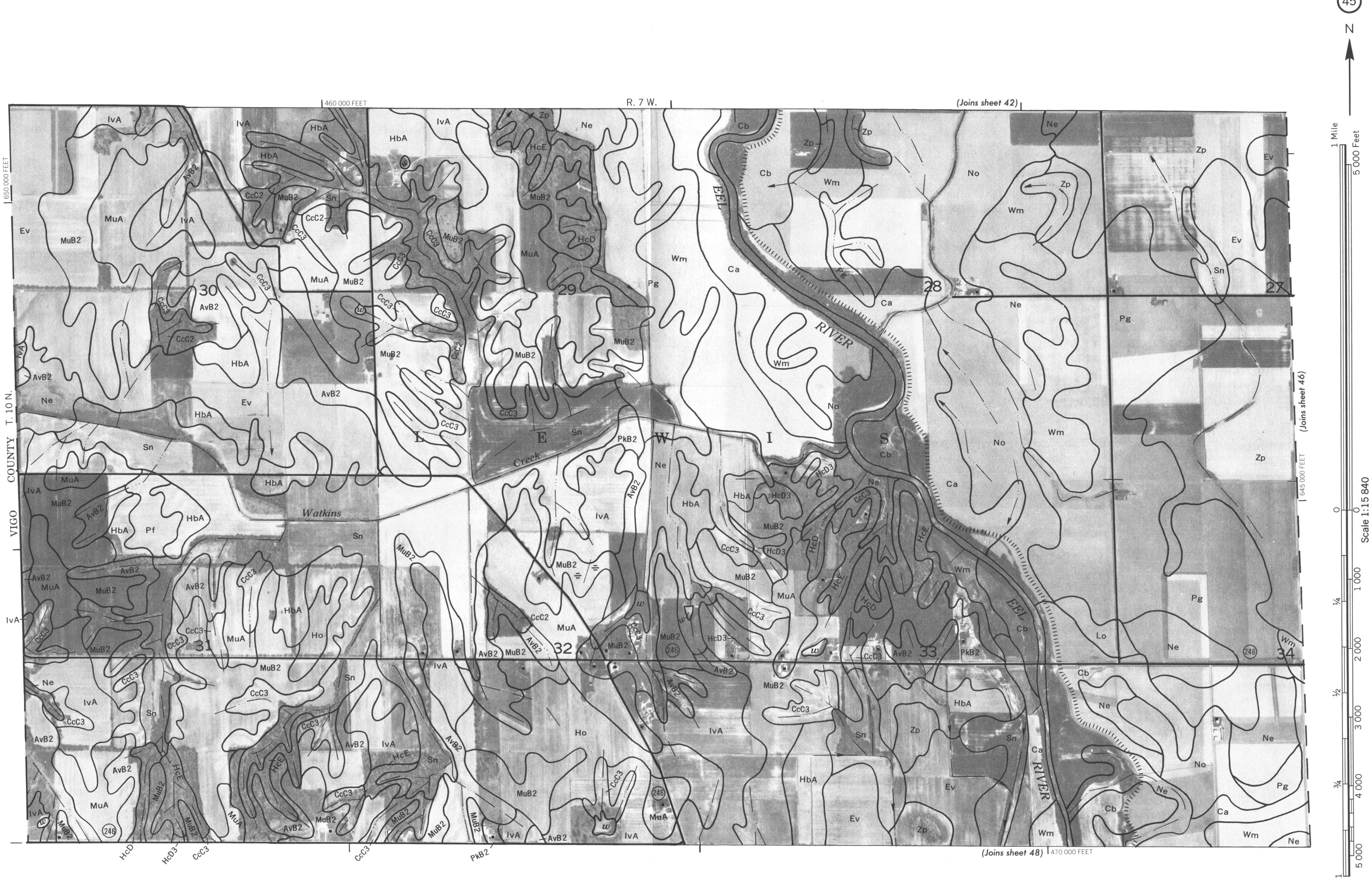
CLAY COUNTY, INDIANA NO. 43

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA NO. 44



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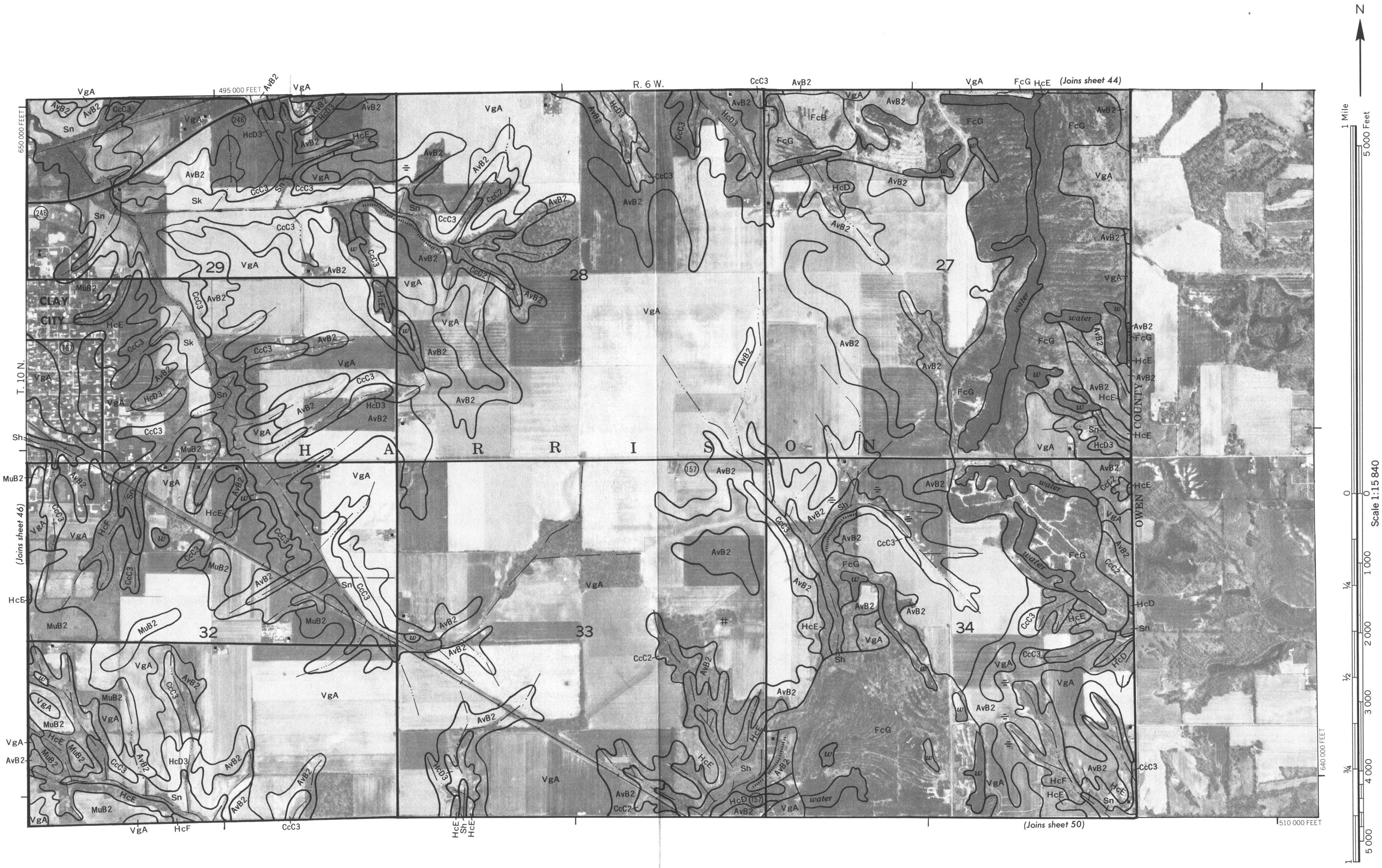
CLAY COUNTY, INDIANA NO. 46

47



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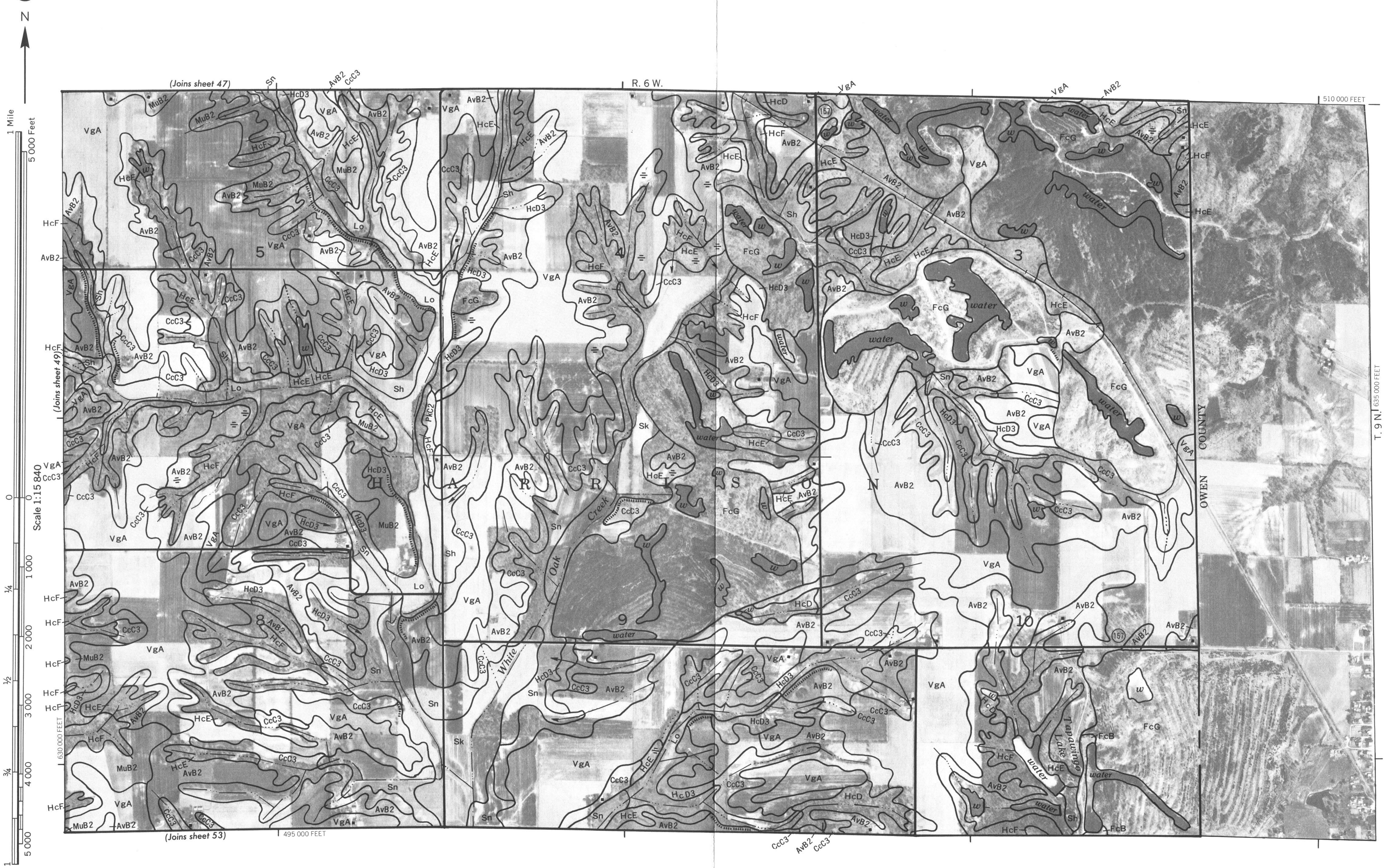
CLAY COUNTY, INDIANA NO. 48

49

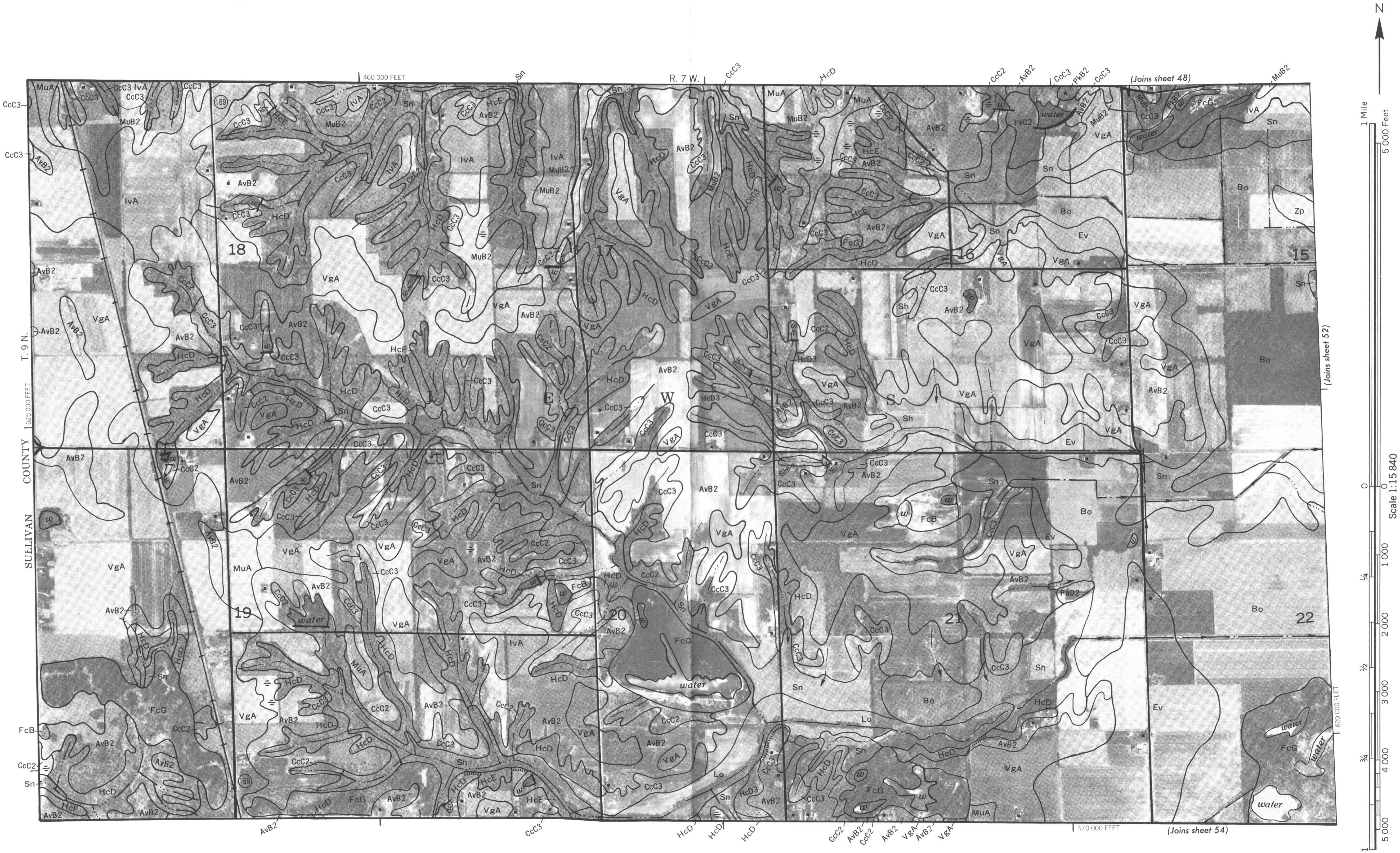
CLAY COUNTY, INDIANA NO. 49

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CLAY COUNTY, INDIANA — SHEET NUMBER 50

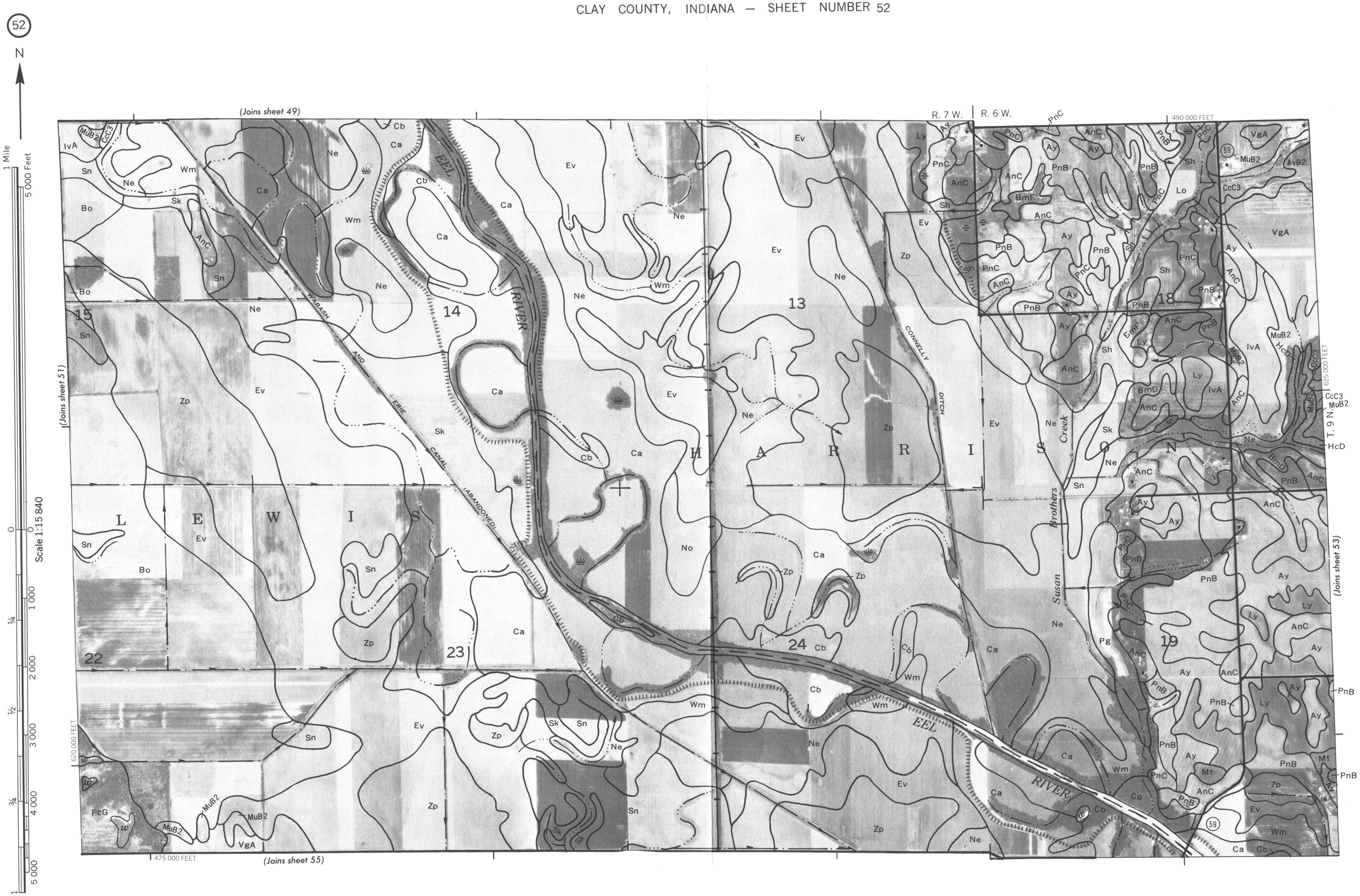


This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

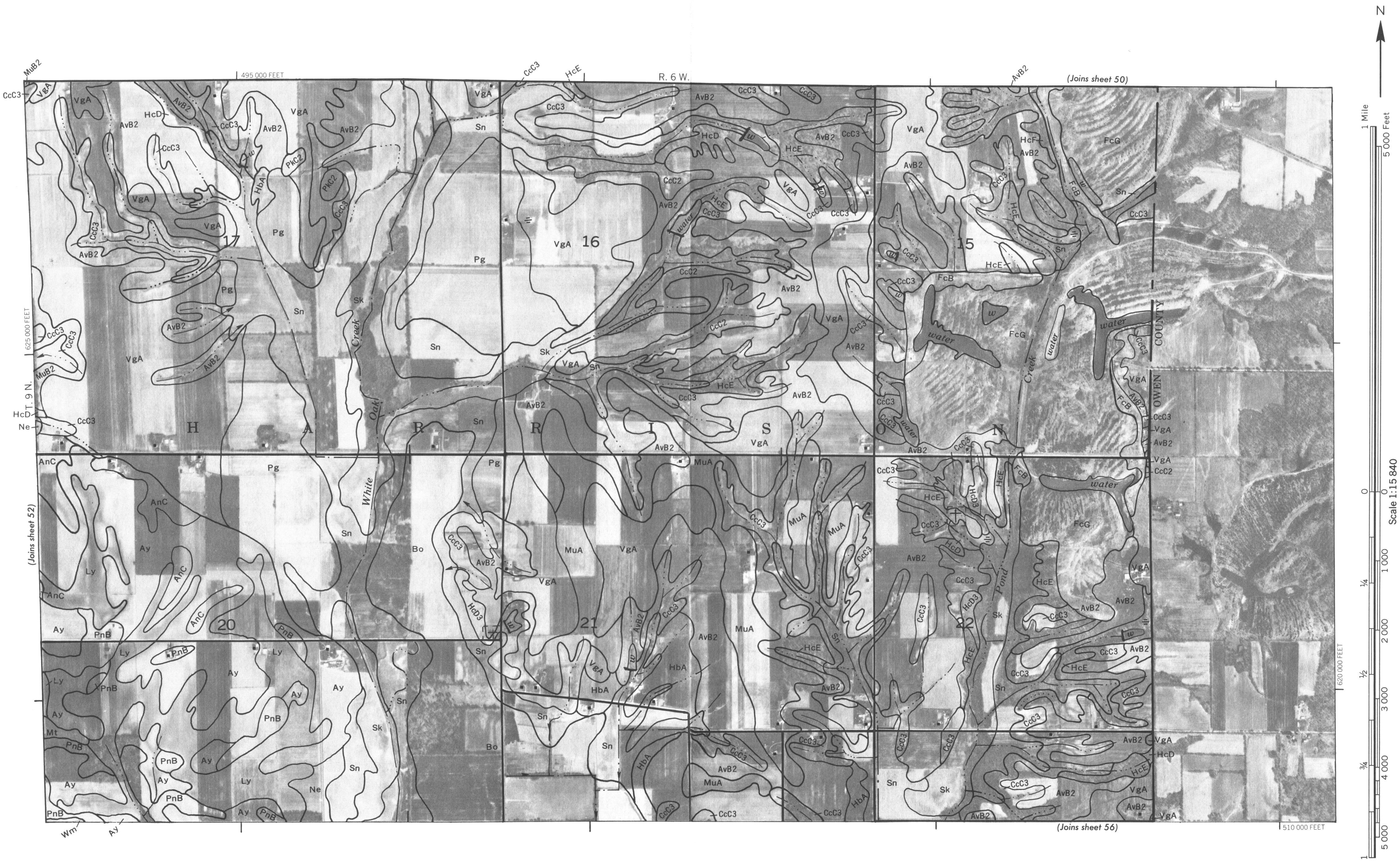


CLAY COUNTY, INDIANA NO. 51

This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1976 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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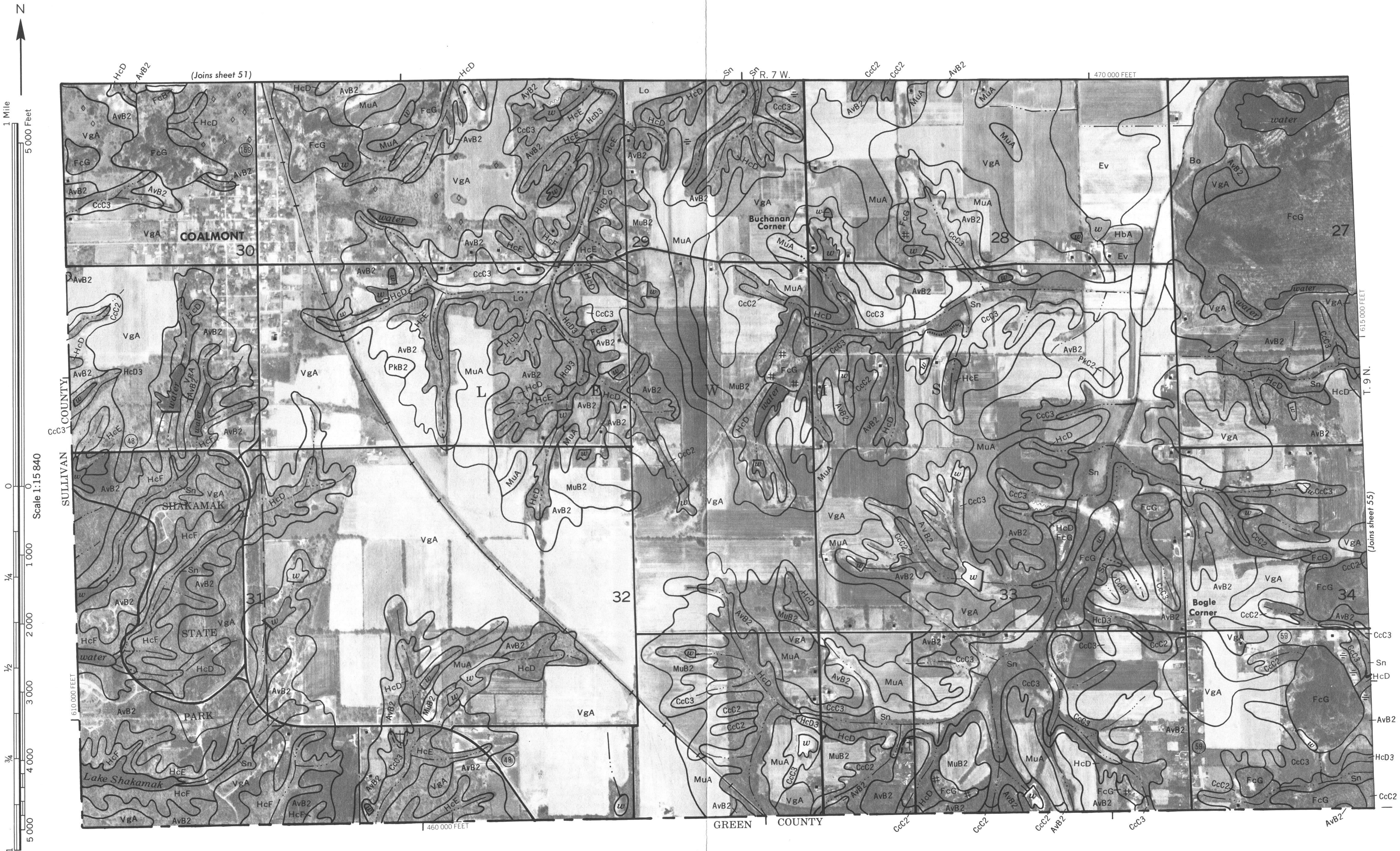
CLAY COUNTY, INDIANA — SHEET NUMBER 54



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